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TRANSACTIONS OF THE SOCIETY.

FIFTH SITTING.

THE meetings of the Society were suspended during the summer. On Monday, October 12th, the sittings were resumed. The meeting was held at the Society's room; the President in the chair, assisted by Dr. Hawks and Mr. Zimmerman, Vice-Presidents.

The chief business transacted was the reading of the second part of General Mosquera's able memoir on the Geography of New Granada, which was listened to with much interest.

Mr. Disturnell presented a copy of Siebold's map of Japan, with a brief memoir on the works of Siebold, written by Mr. Schrœter, "late Secretary of H. R. H. the Prince A. of Prussia." The usual vote of thanks was passed.

SIXTH SITTING.

The November meeting was held on the 8th of the month, at the Society's room. The President in the chair, sustained by Dr. Hawks and Mr. Zimmerman, Vice-Presidents.

Mr. Dwight read the concluding part of General Mos-

quera's paper on New Granada. He mentioned that, owing to some unavoidable delay in the stereotyping, the memoir had not been printed, as General Mosquera hoped it would have been, but that the work would be completed as soon as practicable, when it was the General's intention to present to the Society a sufficient number of copies to furnish its usual circulation.

A vote of thanks to General Mosquera for his paper, read to the Society, and for his intended kindness in the presentation of printed copies, was moved by Dr. Hawks, with appropriate remarks, and after being seconded by Mr. Bloodgood, and sustained by other gentlemen, was unanimously adopted.

Some conversation ensued on several topics, suggested by the paper, such as the utility of plank roads in New Granada, the prospects of social advancement in that republic, the commerce of this country and that, the prospects of a colony of North Americans, &c.

THE SURVEYING SQUADRON OF THE NORTH PACIFIC.

Mr. Bloodgood presented the following letter from Lieutenant Maury, written by order of the Secretary of the Navy, inviting the co-operation of the Society in the preparations for the Surveying Expedition under Commander Ringgold, U. S. N., for the China Seas and the North Pacific.

MR. MAURY'S LETTER.

NATIONAL OBSERVATORY, Washington, Oct., 14, 1852.

The Expedition authorized by the Act of Congress of August 31st, 1852, "for the reconnaissance and survey for naval and commercial purposes, of such parts of Behring's Straits, of the North Pacific Ocean, and of the China Seas, as are frequented by American whaleships, and by trading ves-

sels in their routes between the United States and China," is now fitting out under the command of Cadwalader Ringgold, Commander U. S. Navy.

In a letter of the 24th Sept., from the Secretary of the Navy to the Chief of the Bureau of Ordnance and Hydrography, Mr. Kennedy says: "As it is believed that Professors Henry and Agassiz, and the Geographical Society of New York would prepare papers and other suggestions likely to extend the bounds of useful science, particularly in magnetism and the kindred branches of electricity, meteorology and other phenomena, you will direct Lieut. Maury to address them accordingly on the subject. The Royal Geographical Society of London, so distinguished for its exertions in geodetic and geographic matters, would perhaps furnish interesting information which might add to the success of the Expedition. Hydrographical information might also be obtained from the East India Company of London."

In obedience to this command I therefore have the honor to solicit from the Geographical Society of New York, any remarks and suggestions with regard to the subjects above named, that the Society will have the goodness to make.

The Expedition is fitting out with dispatch; and it will give me pleasure to spread, without loss of time, before the Navy Department, the reply to its request.

Respectfully, &c.

M. F. MAURY, Lt. U. S. N.

Henry Grinnell, Esq,

President Geographical Society, New York.

The letter was referred to the Board, for such attention as the case may require.

On motion of Dr. Hawks, Mr. Shea's late publication on the discovery of the Valley of the Mississippi, was referred to Mr. Leavitt to report thereon.

SEVENTH SITTING.

The Society met regularly on the 14th of December. The President in the chair, and all the Vice-Presidents being present. On account of the great interest felt in hearing Dr. Kane's paper on a new voyage of discovery in the Arctic regions, the meeting was held in the large chapel of the University, which was well filled with a most intelligent auditory.

Dr. Kane was introduced by the President with a few brief statements of his history, object, and plans, and at once proceeded to read his paper. On its conclusion, the following resolution, introduced by Dr. Hawks, was adopted by the Society:

Resolved, That the Society regards with grateful interest the exertions of the Secretary of the Navy in advancing the researches of physical geography, and of its attendant sciences; and that they especially tender him their thanks for the liberality with which he has lent the aid of his department to the expedition destined for the Arctic seas.

Resolved, That the Society appoint a committee of five, to devise means for promoting the scientific organization of Dr. Kane's expedition; and that they be instructed to confer for that purpose with the Secretary of the Navy, the U. S. Coast Survey, and the Smithsonian Institute.

Dr. Hawks, Messrs. Zimmerman, Russell, Leavitt and Barney, were appointed the Committee.

On motion of Dr. Hawks, seconded by Mr. Zimmerman, it was voted that the thanks of the Society be tendered to Dr. Kane, for his able and interesting communication, and that a copy of his memoir and the accompanying chart, be requested for publication in the Bulletin of the Society.

PAPER ON "ACCESS TO AN OPEN POLAR SEA ALONG A NORTH AMERICAN MERIDIAN."

BY E. K. KANE, M. D., PAST ASSISTANT SURGEON IN THE U. S. NAVY.

THE north pole, the remote northern extremity of our earth's axis of rotation, is regarded, even by geographers, with that mysterious awe which envelops the inaccessible and unknown.

It is shut out from us by an investing zone of ice, and this barrier is so permanent, that successive explorers have traced its outline like that of an ordinary seacoast.

The early settlements of Iceland, and their extension to Greenland, as far back as 900 A. D., indicated a protruding tongue of ice from the unknown north, along the coast of Greenland. The early voyages of the Basque and Biscayan fishermen, about 1575, to Cape Breton (for I must express a doubt if the early voyages of Cabot and Frobisher and the Cortereals did more than indicate detached points,) made us aware of a similar ice raft along the coasts of Labrador to the north; and the commercial routes of the old Muscovy company, aided by the Dutch and English whalers, extended this across to Spitzbergen, and thence to the regions north of Archangel in the Arctic seas. The English navigators of the days of Elizabeth, the "notable worthys of the Northe Weste passage," spoke of a similar ice-raft up Baffin's and Hudson's Bays, and the Russo-Siberians gave us vaguely a girding line of ice, which protruded irregularly from the Asiatic and European coasts into the Polar Ocean. Lastly, Cook proved that the same barrier continued across Behring's Straits as high as 70° 44′ north.

From all this it appeared that the approaches to the pole were barricaded with solid ice. We owe to the march of modern discovery, especially stimulated by the search after its great pioneer, Sir John Franklin, our ability accurately to define nearly all the coasts of a great polar sea, if not to lay

down the no less interesting coast of the grand continuous ice border, that encircles it.

I have brought with me for the inspection of the society, a diagram or chart, which will show the completeness with which these may now be delineated.

It is worthy of remark, that this ice, although influenced by winds, currents, and deflecting land masses, retains through the corresponding period of each successive year a strikingly uniform outline.

During the winter and spring, from October to May, or eight months of the year, it may be found traveling down the coast of Labrador almost to Newfoundland, blockading the approaches into Hudson's Bay, and cementing into one great mass the numberless outlets which extend from it and Baffin's Bay to the unknown coasts of the north.

Influenced by the earth's rotation, this ice accumulates towards the westward, leaving an uncertain passage along the eastern waters of Baffin's Bay; after which it resumes its march along the eastern coast of Greenland, shutting in the extensive region appropriated to the interesting Legend or Meteorological Myth, as it has been designated by Humboldt, of "Lost Greenland." Its next course is to the north east, sometimes enveloping Iceland; and thence extending to the east by Jan Meyen's Land and Spitzbergen, it crosses the meridian of Greenwich at some point between the latitudes of 70° and 73°.

I now call your attention to a remarkable feature in this great ice coast line. Upon reaching a longitude of about 70° east, it suddenly turns towards the north, forming a marked indentation as high as latitude 80°; then coming again to the south east until it reaches Cherie Island, it continues on with a varying line to the unexplored regions north of Nova Zembla.

This indentation or sinuosity, best known as the old "Fishing Bight" of the Greenland seas, is undoubtedly due to the thermal influences of the Gulf Stream. We know that the coasts of Nova Zembla feel the influences of its waters; and

Petermann and many others, guided by the projected curves of Dove, suppose that its heated current is deflected by that Peninsula, so as to impress the polar ice to a greater degree of northing than on any other part of our globe.

It would be important to the objects of my communication, that I should trace this ice throughout its entire extent; but I have not the means of doing this with exactness. Barentz, in 1596, was arrested by ice in latitude 77° 25′ upon the Meridan of 70° east. Pront-schitscheff had the same rebuff at the same height, thirty degrees further west (100° east.) Anjou, Matieuschin, and Wrangell found it in a varying belt along the Asiatic coast, at furthest but 50 miles in width.

The enterprise of our American Whalers has also traced this ice, across Behring's Straits, as high as latitude 72° 40′; and it is probable that Kellett Island, in latitude , is a part of a great island chain, continued from Cape Yacan to Banks' Land and the Parry Islands; an archipelago, whose northern faces are yet unexplored, but which undoubtedly serves as a cluster of points of ice cementation, and abounds more or less with Polar ice at all seasons of the year.

We have now followed, throughout its entire circuit, this immense investing body. The Circum-Polar ice, as I will venture to name it, may be said to bound an imperfect circle of 6000 miles in circumference, with a rude diameter of 2000 miles, and an area, if we admit its continuity to the Pole, one-third larger than the Continent of Europe.

But theory has determined that this great surface is not continuous. It is an annulus, a ring surrounding an area of open water,—the Polynya, or Iceless Sea.

Polynya is a Russian word, signifying an open space; and it is used by the Siberians to indicate the occasional vacancies which occur in a frozen water surface. Although such a vacancy as applied to a Polar sea is generally recognized to exist, it is right for me to state that this opinion is not based upon the results of exploration. It is due rather to the well elaborated inductions of Sabine, and Berghaus, and especially of our accomplished American Hydrographer,

Lieutenant Maury. The observations of Wrangell and Penny, and still more lately of Captain Inglefield, although strongly confirmatory, were limited to a range of vision in no instance exceeding fifty miles, and were subject to all the deceptions of distance. As, however, the arguments in favor of the existence of such a sea are of the highest interest to future geographical research, and so far as I am aware have never yet been grouped together, I shall take the liberty of presenting them to the society.

The North Polar Ocean is a great Mediterranean, draining the northern slopes of three Continents, and receiving the waters of an area of 3,751,270 square miles. Indeed, the river systems of the Arctic Sea exceed those of the Atlantic.

The influences of congelation, too, aided by the diminished intensity and the withdrawal of the solar ray, increase the atmospheric precipitation, and probably diminish the compensating evaporation. Yet, this position calls for further investigation to establish it absolutely; for recent experiments show, that even in the dark hours of winter, and at temperatures 50 degrees below zero, evaporation goes on at a rapid rate.

That the position holds, however, in general terms, is evident from the diminished specific gravity of the Arctic waters. These seas are less salt than those of more equatorial regions. The average specific gravity (1.0265) indicates about 3.60 per cent. of saline matter, while those of the Atlantic, south of 40°, give 5.

The atmospheric precipitation extending to the adjacent land slopes, the melting of the snows and accumulated glacial material, and the floods of the great Siberian rivers, are sufficient to account for this.

With these sources of supply, it is evident that this surcharged basin must have an outlet, and its contents a movement, independent of the generally operative laws of currents, which would determine them toward the Equator.

The avenues of entrance to and egress from this Polar basin, are but three; Behring's Straits, the Estuaries of Hudson's and

Baffin's Bays, and the interval between Greenland and Norway upon the Atlantic Ocean, known as the Greenland Sea. In Behring's Straits, it is probable from imperfect observations, that the surface current sets, during a large portion of the year, from the Pacific into the Arctic Sea, with a velocity varying from one to two and a half knots an hour. Neither the soundings nor the diameter of this strait indicate any very large deep-sea discharge in the other direction.

The Gulf Stream, after dividing the Labrador current, has been traced by Professor Dove, to the upper regions of Novaia Zemlia; so that Baffin's Bay, and the Hudson and Greenland seas, constitute the only uniform outlet to the Polar basin.

It is by these avenues, then, that the enormous masses of floating ice, with the deeply immersed berg, and the still deeper belt of colder water, are conveyed outward. Underlying the Gulf Stream, whose waters it is estimated at least to equal in volume, the vast submerged icy river flows southward to the regions of the Caribbean. The recent labors of the U. States Coast Survey and Nautical Observatory have, as the Society is aware, developed and confirmed the previously broached idea of a compensating system of Polar and Tropical currents; and we are prepared to consider these colder streams, as equalizers to the heated areas of the tropical latitudes, and analogous in cause and effect to the recognized course of the atmospheric currents.

In fact, Dove, Berghaus, and Petermann, three authorities for whom I have the highest respect, recognize for the Arctic Ocean a system of revolving currents, whose direction during Summer is from North to South, and during Winter the reverse, or from the South to the North. The isotherms of Lieut. Maury, (projected by Prof. Flye), point clearly to the same interesting result. Contrasting these great movements of discharge and supply with the surface actions, we find during the Summer months, a movement along the northern coasts of Russia, clearly from East to West, from Novaia Zemlia westwardly and south-westwardly to Spitzbergen, where, after an obscure bifurcation, it is met by a great drift

from the north, and carried along the coast of Greenland, in a large body known as the East Greenland current. The observations collected by Lieut. Commanding De Haven, show that this stream is deflected around Cape Farewell, passing up the Greenland coast to lat. 74° 76′; where, after coming to the western side of the Bay, it passes along the eastern coast of America, even to the Capes of Florida. During the winter, when the great rivers of Siberia and America lose their volume by the action of the frost, a current has been noted from the Faroe Islands, North and East, along the Asiatic coast, towards Behring's Straits. And then it is, that the great surface ice, formed upon the coasts of Asia, gives place to a warmer stream, and the heated waters of the Gulf current bathe and temper the line of the Siberian coast.

All these facts go to prove that the Polar basin is not only the seat of an active supply and discharge, but of an intestine circulation independent of either; while the inter-communication of the whales, (*B. Mysticus*), between the Atlantic and Pacific, as shown by Maury, proves directly that the two oceans are united.

Admitting the important fact of a moving open sea, the recognized equalization of temperatures, attending upon large water masses, follows of course. But, is the Arctic sea, in fact, an unvaried expanse of water? For if it be not, the excessive radiation and disturbing influence of land upon general temperature, is well known. It is, I think, an open sea. I deduce an argument for this belief from the icebergs. The iceberg is an offcast from the Polar glacier, and needs, as an essential element in its production, (as much as a ship, the dockyard, on which she is built, and from which she is launched), land. From the excessive submergence of these great detached masses, they may be taken as reliable indices of the deep-sea currents, while their size is such that they often reach the latitudes of the temperate zone before their dissolution. Now, it is a remarkable fact, that these huge ice-hulks are confined to the Greenland, Spitzbergen, and Baffin seas. Throughout the entire circuit of the Polar Ocean, almost seven thou-

sand miles of circumscribing coast, we have but 40° which is ever seen to abound in them.

A second argument, bearing upon this, is found in the fact, that a large area of open water exists between the months of June and October in the upper parts of Baffin's Bay. This Mediterranean Polynya is called by the Whalers, the North Water. After working through the clogging ice of the intermediate drift, you pass suddenly into an open sea, washing the most northern known shores of our Continent, and covering an area of 90,000 square miles.

This iceless interval is evidently caused by the drift having traveled to the south without being reinforced by fresh supplies of ice; and the latest explorations from the upper waters of this bay speak of avenues, 36 miles wide, extending to the north and east, and free.

The temperature of this water is sometimes 12° above the freezing point; and the open bays or sinuosities, which often indent the Spitzbergen ice as high as 81°, have been observed to give a sea-water temperature as high as 38° and 40°, while the atmosphere indicates but 16° above zero.

But besides these, we have arguments growing out of the received theories of the distribution of temperature upon the surface of the earth.

The actual distribution of heat in this shut-out region can only be inferred.

The system of Isothermals, projected by Humboldt upon positive data, ceased at 32°; and the views of Sir John Leslie (based upon Mayer's theorem, that the north Pole was the coldest point in the Arctic regions,) have, as the members are aware, since been disproved.

Sir David Brewster, by the combination of the observations of Scoresby, Gieseke, and Parry, determined the existence of two poles of cold, one for either hemisphere, and both holding a fixed relation to the Magnetic Poles. These two seats of maximum cold are situated respectively in Asia and America, in longitudes 100° west and 95° east, and on the parallel of 80°. They differ about 5° in their mean annual

temperature; the American, which is the lower, giving three degrees and a half below zero. The iso thermals surround these two points, in a system of returning curves, yet to be confirmed by observation; but the inference, which I present to you without comment or opinion, is, that to the north of 80°, and at any points intermediate between these American and Siberian centers of intensity, the climate must be milder, or more properly speaking, the mean annual temperature must be more elevated.

Petermann, taking as a basis the data of Professor Dove, deduces a movable pole of cold, which in January is found in a line from Melville Island to the River Lena, and gradually advancing with the season into the Atlantic Ocean, recedes with the fall and winter to its former position. Such a movement is clearly referable to the summer land currents with their freight of polar ice.

With the consolidation of winter, the ice recedes, and the Gulf stream enters more perceptibly into the far north. The mean temperature of the northeast coast of Siberia is 40°, or 50° colder than that of the western shores of Novaia Zemlia, while in July it is 20° higher.

But, if any point between 75° and 80°, a range sufficiently wide to include all the theories, be regarded as the seat of the greatest intensity of cold, we may perhaps infer the state of the Polar sea from the known temperatures of other regions, equally distant with it from this supposed center; though, as the lines of latitude do not correspond with those of temperature, this must be done with caution.

I have been engaged for some time in tracing out this class of deductions, and I find that they point to some interesting conclusions as to the fluidity of the region about the Pole, and its attendant mildness of the weather.

Thus, for instance, at Cherie Island, surrounded by moving waters, but in as high a latitude as Melville Island, the seat of the greatest observed mean annual cold, the temperature was found so mild throughout the entire Arctic Winter, that rain fell there upon Christmas day.

2. Barentz, a most honest and reliable authority, speaks of the increasing warmth as he left the land to the north of 77°. The whalers north of Spitzbergen, confirm the saying of the early Dutch, that the "Fisherman's Bight" is as pleasant as the sea of Amsterdam.

3. Egedesminde and Rittenback, two little Danish and Esquimaux settlements on the west coast of Greenland, in lat. 70,° with a climate influenced by adjacent land masses, but, nevertheless, not completely ice-bound, have a mean annual temperature of , and are in the iso thermal curve (summer curve) of 50°; giving us a vegetation of coarse grasses, and a few crucifers.

4. In West Lapland, as high as 70°, barley has been and I believe is still grown; though here is its highest northern limit. If 80° be our center of maximum cold, the Pole at 90° is at the same distance from it as this West Lapland limit of the growth of barley.

So, with a little more sun, a few weeks longer, they might grow grain against the North Pole!

But there are other arguments based upon known facts, facts popularly recognized, and direct in their inductive bearings upon the theory of an open sea.

The migrations of animal life. At the utmost limits of northern travel attained by man, hordes of animals of various kinds have been observed to be traveling still further.

The Arctic zone, though not rich in species, is teeming with individual life. Among birds, the swimmers, drawing their subsistence from open water, are predominant; the great families of ducks (*Anatinæ*), *Auks* (*Alcinæ*), and Procellarine birds, (*Procellarinæ*) throng the seas and passages of the far North, and even incubate in regions of unknown northernness. The Eider duck has been traced to breeding grounds as high as 78° in Baffin's Bay, and in conjunction with the Brent goose, seen by us in Wellington Channel, and the Loon and little Auk, pass in great flights to the northern water beyond. The mammals of the sea, the huge cetacea, in the three great families, *Belinedæ*, *Delphinedæ* and *Phocidæ*, represented by

the whales, the Narwhal and Beluga, the Seal, and that strange marine Pachyderm, the tusky walrus, all pass in *schools* towards the northern waters. I have seen the white whale (*Delphinipterus Beluga*), passing up Wellington Channel to the North, for nearly four successive days, and that, too, while all around us was a sea of broken ice.

So with the quadrupeds of this region. The equatorial range of the polar bear (*U. Maritimus*), is misconceived by our geographical zoologists. It is further to the north than we have yet reached; and this powerful beast informs us of the character of the accompanying life, upon which he preys.

The ruminating animals, whose food must be a vegetation, obey the same impulse or instinct of far northern travel. The reindeer (*Cervus Tarandus*), although proved by my friend Lieut. McClintock to winter sometimes in the Parry group, outside of the zone of woods, comes down from the north in herds as startling as those described by the Siberian travelers, a "moving forest of antlers."

The whalers of North Baffin's Bay, as high as 75°, shoot them in numbers, and the Esquimaux of Whale Sound, 77°, are clothed with their furs. Five thousand skins are sent to Denmark from Egedesminde and Holsteinberg alone.

Before passing from this branch of my subject, I must mention also that the polar drift ice comes first from the north. The breaking up, the thaw of the ice-plain, does not commence in our so called warmer south, but in regions to the north of those yet attained. Wrangell speaks of this on the Asiatic seas, Parry above Spitzbergen, and my friend Capt. Penny, shrewd, bold, and adventurous, confirms it in his experience of Wellington Sound.

In addition to all this, we have the observations of actual travel; although this, confirmatory as it is, must, likethe theoretical views, be received with caution. Barentz saw an opening water beyond the northernmost point of Europe; Anjou the same beyond the Siberian Bear islands: and Wrangell, in a sledge journey from the mouth of the Kolyma, speaks of a "vast illimitable ocean," illimitable to mortal vision.

To penetrate this icy annulus, to make the "northwest passage" the northeast passage, to reach the pole, have been favored dreams since the early days of ocean navigation. Yet up to this moment, complete failure has attended every attempt. One voyager, William Scoresby, known to the scientific world for the range and exactness of his observation, passed beyond the latitude of 81° 30′. But after discarding the apochryphal voyages of the early Dutch, whose imperfect nautical observation rendered entirely unreliable their assertions of latitudes, we have the names of but two who may be said to have attained the parallel of 82°; Heindrich Hudson in 1607, and Edward Parry in our own times.

This latter navigator felt that the sea, ice-clogged with its floating masses, was not the element for successful travel, and with a daring unequaled I think in the history of personal enterprise, determined to cross the ice upon sledges. The spot he selected was north of Spitzbergen, a group of rocks called the Seven Islands,—the most northern known land upon our globe. With indomitable resolution he gained within 435 miles of his mysterious goal, and then unable to stem the rapid drift to the southward, was forced to return.

But the question of access to the Arctic pole, the penetration to this open sea, is now brought again before us, not as in the days of Hudson and Scoresby and Parry, a curious problem for scientific inquiry, but as an object claiming philanthrophic effort, and appealing thus to the sympathies of the whole civilized world,—the rescue of Sir John Franklin and his followers.

The recent discoveries by the united squadrons of De Haven and Penny, of Franklin's first winter quarters at the mouth of Wellington Channel, aided by the complete proofs since obtained that he did not proceed to the east or west, render it beyond conjecture certain that he passed up Wellington Channel to the North.

Here we have lost him; and, save the lonely records upon the tomb stones of his dead, for seven years he has been lost to the world. To assign his exact position is impossible: we

only know that he has traveled up this land-locked channel, seeking the objects of his enterprise to the North and West. That some of his party are yet in existence, this is not the place to argue. Let the question rest upon the opinions of those who, having visited this region, are at least better qualified to judge of its resources than those who have formed their opinions by the fireside.

The journeys of Penny, Goodsir, Manson, and Sutherland, have shown this tract to be a tortuous estuary, a highway for the polar ice drift, and interspersed with islands, as high as latitude 77°; beyond which they could not see. It is up this channel, that the searching squadron of Sir Edward Belcher has now disappeared, followed by the anxious wishes of those who look to it as the final hope of rescue. I regret to say, that after considering carefully the prospects of this squadron, I have to confess that I am far from sanguine as to its success. It must be remembered, that Wellington Channel is all that has just been stated, tortuous, studded with islands, and a thoroughfare for the northern ice; and the open water, sighted by Captain Penny, is not to be relied on, either as extending very far, or as more than temporarily unobstructed. If we look up from the highlands of Beechy Head, fifty miles of apparently open navigation is all that we can assert certainly to have been attained by the searching vessels, and to reach the present known limits of the sound would require a progress in a direct line on their part of at least 130 miles.

They left, moreover, on the fifth of August; and early as this is there considered, and open as was the season, they have but forty days before winter cements the sea, or renders navigation impossible by clogging the running gear. By a fortunate concurrence of circumstances the squadron of Sir Edward Belcher may do every thing; but I must repeat that I am far from sanguine as to their success. The chances are against their reaching the open sea.

It is to announce, then, another plan of search that I am now before you; and as the access to the open sea forms its characteristic feature, I have given you the preceding outline

of the physical characteristics of the region, in order to enable you to weigh properly its merits and demerits.

It is in recognition of the important office which American geographers may perform towards promoting its utility and success, that I have made the society the first recipient of the details and outlines of my plan.

Henry Grinnell, the first president and now a vice-president of this society, has done me the honor of placing his vessel, the Advance, at my disposition; and the secretary of the navy has assigned me to "special duty" for the conduct of the expedition.

My plan of search is based upon the probable extension of the land masses of Greenland to the far north—a view yet to be verified by travel, but sustained by the analogies of physical geography. Greenland, though looked upon by Giéseke as a congeries of islands cemented by interior glaciers, is in fact a peninsula, and follows in its formation, the general laws which have been recognized since the days of Forster, as belonging to peninsulas with a southern trend. Its abrupt truncated termination at Staaten-Hook is as marked as that which is found at the Capes Good Hope and Horn of the two great continents, the Comorin of Peninsular India, Cape South East of Australia, or the Gibraltar of southern Spain.

Analogies of general contour, which also liken it to southern peninsulas, are even more striking. The island groups, for instance, seen to the east of these southern points, answering to the Falkland Islands, Madagascar, Ceylon, New Zealand, the Bahamas of Florida, and the Balearics of the coast of Spain, are represented by Iceland off the coast of Greenland. It has been observed that all great peninsulas, too, have an excavation or bend inwards on their Western side, a "concave inflection" towards the interior. Thus, South America between Lima and Valdivia, Africa in the Gulf of Guinea, India in Cambaye, and Australia in the Bay of Nuges, are followed by Greenland' in the great excavation of Disco. Analogies of the same sort may offer, when we consider those

more important features of relief so popularly yet so profoundly treated by Prof. Guyot.

Greenland is lined by a couple of lateral ranges, metamorphic in structure, and expanding in a double axis to the N. N. W. and N. N. E. They present striking resemblances to the Ghauts of India, being broken by the same great injections of greenstone, and walling in a plateau region where glacial accumulations correspond to those of the Hindostan plains.

The culmination of these peaks in series indicâtes strongly their extension to a region far to the North. Thus from the south cape of Greenland to Disco Bay, in lat. 70°, the peaks vary in height from 800 to 3,200 feet. Those of Pröven, lat. 71°, are 2,300, and those observed by me in lat. 76° 10′, gave sextant altitudes of 1,380 feet, with interior summits at least one-third higher.

The same continued elevation is observed by the whalers as high as 77°, and Scoresby noted nearly corresponding elevations on the eastern coasts in lat. 73°. The coast seen by Inglefield to the north of 78° was high and commanding.

From these alternating altitudes, continued throughout a meridian line of nearly eleven hundred geographical miles, I infer that this chain follows the nearly universal law of a gradual subsidence, and that Greenland is continued farther to the north than any other known land. In the old continents the land slopes toward the Arctic sea; but although in the new world the descent of the land generally is to the east, the law of the gradual decline of meridional chains is universal.

Believing, then, in such an extension of Greenland, and feeling that the search for Sir John Franklin is best promoted by a course which will lead directly to the open sea,—feeling, too, that the approximation of the meridians would make access to the west as easy from Northern Greenland as from Wellington Channel, and access to the east far more easy,—feeling, too, that the highest protruding headland will be most likely to afford some trace of the lost party,—I am led to propose and attempt this line of search.

Admitting such an extension of the land masses of Greenland to the north, we have the following inducements for exploration and research.

1. Terra firma as the basis of our operations, obviating the capricious character of ice travel.

2. A due northern line, which, throwing aside the influences of terrestrial radiation, would lead soonest to the open sea, should such exist.

3. The benefit of the fan-like abutment of land, on the north face of Greenland, to check the ice in the course of its southern or equatorial drift, thus obviating the great draw-back of Parry in his attempts to reach the Pole by the Spitzbergen sea.

4. Animal life to sustain traveling parties.

5. The co-operation of the Esquimaux, &c.; settlements of these people having been found as high as Whale Sound, and probably extending still further along the coast.

The point I would endeavor to attain would be the highest attainable seats of Baffin's Bay, from the sound known as Smith's Sound, and advocated by Baron Wrangell as the most eligible site for reaching the North Pole.

As a point of departure it is two hundred and twenty miles to the north of Beechy Island, the starting point of Sir Edward Belcher, and seventy miles north of the utmost limits seen or recorded in Wellington Channel.

The party should consist of some thirty men, with a couple of launches, sledges, dogs, and gutta percha boats. The provisions to be pemmican, a preparation of dried meat, packed in cases impregnable to the appetite of the polar bear.

We shall leave the United States in time to reach the bay at the earliest season of navigation. The brig furnished by Mr. Grinnell for this purpose, is admirably strengthened and fully equipped to meet the peculiar trials of the service. After reaching the settlement of Uppernavik, we take in a supply of Esquimaux dogs, and a few picked men to take charge of the sledges.

We then enter the ice of Melville Bay, and if successful in penetrating it, hasten to Smith's Sound, forcing our vessel to the utmost navigable point, and there securing her for the winter. The operations of search, however, are not to be suspended. Active exercise is the best safe-guard against the scurvy; and although the darkness of winter will not be in our favor, I am convinced that with the exception, perhaps, of the solstitial period of maximum obscurity, we can push forward our provision depots, by sledge and launch, and thus prepare for the final efforts of our search.

In this I am strengthened by the valuable opinion of my friend, Mr. Murdaugh, late the sailing master of the Advance. He has advocated this very Sound as a basis of land operations. And the recent journey of Wm. Kennedy, commanding Lady Franklin's last expedition, shows that the Fall and Winter should no longer be regarded as lost months.

The sledges which constitute so important a feature of our Expedition, and upon which not only our success but our safety will depend, are to be constructed with extreme care. Each sledge will carry the blanket, bags, and furs of six men, together with a measured allowance of pemmican; a light tent of india-rubber cloth, of a new pattern, will be added; but for our nightly halt the main dependence will be the snow house of the Esquimaux. It is almost incredible, in the face of what obstacles, to what extent, a well organized sledge party can advance. The relative importance of every ounce of weight can be calculated, and the system of advanced depots of provisions organized admirably.

Alcohol or tallow is the only fuel; and the entire cooking apparatus, which is more for thawing the snow for tea-water than for heating food, can be carried in a little bag. Lieut. Mc Clintock, of Commander Austin's expedition, traveled thus 800 miles—the collective journeys of the expedition equaled several thousand; and Baron Wrangell made by dogs 1,533 miles in seventy-four days, and this over a fast frozen ocean.

But the greatest sledge journey upon record is that of my

friend, Mr. Kennedy, who accomplished nearly 1,400 miles, most of it in mid-winter, without returning upon his track to avail himself of deposited provisions. His only food—and we may here learn the practical lesson of the traveler to avoid unnecessary baggage—was pemmican, and his only shelter the *snow house.*

It is my intention to cover each sledge with a gutta percha boat—a contrivance which the experience of the English has shown to be perfectly portable. Thus equipped, we follow the tract of the coast, seeking the *open water.*

Once there, if such a reward awaits us, we launch our little boats, and bidding God speed us, embark upon its waters.

Gentlemen of the Society,—if I may be permitted particularly to address you—the resources of those whose philanthropy has fitted out this expedition, must be scrupulously appropriated to the single object of search. But this search is not merely a voyage of rescue; it appeals to the highest interests of scientific inquiry; but to physical geography especially.

A simple inspection of the proposed line of travel will show its peculiar availability for purposes of physical research.

In thermal science, it will connect and continue in series the observations instituted by the Danish Government on the lower coast of Greenland. Thus affording new and valuable data for the extension of the positive *Isotherms*, and the determination of the distribution of heat upon the surface of the globe.

In terrestrial magnetism, perhaps no spot could be found where an accurate registration would be more valuable. It is intermediate between the Asiatic and American Magnetic Poles, and on a meridian line bearing a uniform relation to each. The elements most wanting in the Gaussian formula might here be contributed largely, and additional light be thrown upon the great questions of the amount and direction of the earth's magnetic force.

So important are these objects, that Prof. Henry, with that liberal view of the objects of the Smithsonian Institution which has made it to be already recognized as fulfilling the just intentions of its founder, "the diffusion of knowledge among men," has volunteered, upon the contingency of future payment, to order the necessary instruments; and the Hon. the Secretary of the Navy, himself a votary of science, and fully able to reconcile its high interests with his official duties, has commended an organization of this branch of my approaching duties to the attention of Congress.

Such an organization it would be my pride to mature, and my labor to render effective. I ask from you such a co-operation as is due to the character of your learned body, and the importance of the interests which it has assumed to take under its charge.

CORRECTIONS.

OWING to the absence and multiplied avocations of Dr. Kane, who was engaged in preparations for his voyage, during the time these sheets were passing through the press, a number of errors escaped correction. The most important of them are the following:—

Page 87, line 15, for "Kellett Island, in latitude ——," read "Herald Island, in latitude 71° 17'."
Page 88, line 23, for "diminished" read "inferior."
" " " 26 and 27, dele all the sentence after the word "matter."
" 89, " 27, for "for whom I have," read "entitled to."
" 90, " 27, for "I deduce an argument," read "and an argument may be deduced."
Page 90, line 28, after "needs," read "land," and omit the word "land" in line 31.
" 92, " 2, for "iso-thermals," read "Isothermals."
" " " 29 and 30, for "engaged for some time in tracing out this class of deductions," read "interested for some time in examining this class of facts."
Page 92, line 32, dele "the" before "weather."
" " " 34, for "as high latitude as," read "a higher latitude than."
" 93, " 17, exclamation (!) after "barley."
" " " 18 and 19, both lines should be omitted.
" " " 21, dele "and direct in their inductive."
" " " 29 and 30, the Latin names should read "*Anatinæ, Alcinæ, Procellarinæ.*"
Page 93, last line, read "*Belinidæ, Delphinidæ.*"
" 94, line 1, for "Beluga, the Seal, and," read "the Seal, as well as."

[illegible] MEETING.

The adjourned meeting was held in the Geological Room, on the 21st of December, the President in the chair.

The Committee on the Kane Expedition reported that they had undertaken to provide the necessary [illegible] for the Expedition [illegible] for Dr. Kane, and were making good progress in the subscription for that object. They had also opened a correspondence with the Secretary of the Navy, the Smithsonian Institution, the American Philosophical Society at Philadelphia, and the Academy at Cambridge, in reference to cooperation and unity of [illegible]. The Committee was continued.

The following donations were presented.

Through Mr. Russell, the Chief Librarian presented three large volumes of the Documentary History of New York.

Mr. [illegible] presented a copy of his [illegible] Map of New England, which was referred to Messrs. [illegible], and Colonel [illegible], to report at a future meeting.

Mr. Disturnell presented a copy of his Map of Mexico, which was referred to in the treaty of Guadalupe Hidalgo, on which was marked the line that had occasioned so much difficulty in running the boundary line. Also a drawing of the section containing the error, with the correction.

A copy of the Maryland census was presented by Mr. Kennedy, the superintendent of the census.

Mr. Leavitt presented a copy of [illegible] Walling's report on

EIGHTH SITTING.

The adjourned meeting was held at the Society's Room, on the 21st of December, the President in the chair.

The Committee on the Kane Expedition, reported that they had undertaken to provide the means of employing a scientific assistant for Dr. Kane, and were making good progress in the subscription for that object. They had also opened a correspondence with the Secretary of the Navy, the Smithsonian Institution, the American Philosophical Society, at Philadelphia, and Prof. Agassiz, at Cambridge, to secure co-operation and unity of counsels. The committee was continued.

Several donations were presented.

Through Mr. Russell, the State Librarian presented three large volumes of the Documentary History of New-York.

Mr. Colton presented a copy of his new and beautiful Map of New England, which was referred to Messrs. Leavitt, E. Blunt, and Cotheal, to report thereon.

Mr. Disturnell presented a copy of his Map of Mexico, which was referred to in the treaty of Guadalupe Hidalgo, on which was marked the error that has occasioned so much difficulty in running the boundary line. Also a drawing of the section containing the error, with the correction.

A copy of the Maryland census was presented by Mr. Kennedy, the superintendent, on request of Gov. Fish.

Mr. Leavitt presented a copy of Prof. Whitney's report on the Geology of Lake Superior, with accompanying maps, received from Senator Chase.

Also, from the writers, pamphlets on railway communications between the Atlantic and Pacific, by Mr. Alexandre, of Baltimore, and Mr. Plumbe.

Dr. Hawks presented several public documents received through the attention of Senator Fish:

1. Stansbury's Report on the Survey of Salt Lake.
2. Report on Light Houses.

3. Constitutions of the United States, and of the several States.

Mr. Bloodgood stated that a company has been formed to establish steam navigation on the river Paraguay; that a steamboat has been purchased, and is in course of preparation for the voyage, and to be run as far up the river as it is navigable; and that a free passage out and up the river, and at all times, will be given to any agent which this Society may employ, to make explorations and discoveries in that interesting region. A committee was appointed to report on this offer.

Thanks were voted unanimously to these donors, and to Mr. Bloodgood.

The Board reported a reply to the letter of inquiry by Lieut. Maury, in regard to the Surveying Expedition in the China Seas; and the corresponding secretary was instructed to communicate the reply to the Secretary of the Navy—urging especially the importance of making exact trigonometrical surveys, and marking them by permanent monuments, as the basis of future surveys "for naval and commercial purposes, in Behring's Straits," &c.

CENTRAL MEXICO.

The society then listened, with much interest, to an address or lecture by Col. Ramsey, late U. S. A., on the courses of the rivers and mountain ranges in Central Mexico, correcting some alleged errors of Humboldt on these points, and describing at considerable length the topography, soil, climate, productions, and condition of society in that region, with some reference to the facilities there existing for a line of inter-oceanic communication from Vera Cruz to the Pacific.

Several gentlemen, heretofore proposed, were elected members of the Society.

A PAPER ON THE GROWTH, TRADE, AND MANUFACTURE OF COTTON,

BY J. G. DUDLEY.

[The following elaborate paper on the "Growth, Trade, and Manufacture of Cotton," by J. G. Dudley, Esq., one of the Merchants of our city, was read before the New York Historical Society. Its object falls so naturally within the scope and objects of the American Geographical and Statistical Society, that the Publishing Committee have asked and obtained permission to insert it in the present number of the Bulletin.]

It is a just remark of a modern writer, who has veiled his name in the mantle of his modesty, "That of the *true history* of mankind, only a few chapters have yet been written."

The physical wants of man in a civilized state, exceed altogether his individual powers of supply. Hence he is of necessity a *social being;* and his wants and his desires are in a great measure dependent for their attainment upon his fellow men, and inseparably connected with correlative duties to them. *This is human destiny.* It would seem, therefore, that whatever tends to the advancement of our race, and the amelioration of its condition, is a part of "the true history of mankind," and ought to be written. And that those persons who by their labors and exertions, whether mental or physical, have done the most to that end, are justly entitled to the highest niche in the temple of human glory. Yet how different has been the experience of past ages! While the deeds of the warrior, who rode forth to pillage and destroy, have been blazoned to the world in history and monument

and song, the *true heroes* in the cause of humanity, the *patient inventors*, the *great captains of industry*, and promoters of the *arts of peace*, together with their labors, have been too often suffered by the historian to sink into oblivion. Fortunately for our race, a new era has dawned upon us. Men have begun to perceive that the arts of peace are the true sources of national strength, as well as of individual prosperity; that the proper duty of the historian and poet is to celebrate and record the deeds of those who have done the most to increase human comfort and happiness, rather than of those who by battle and conquest have been instrumental in destroying both; *that he who invents a machine which lessens human toil and increases human comfort, is a greater benefactor to his race* than he who simply inherits a crown, or receives the applause of the world for splendid military achievements. In the development of the uses to which some of the simple vegetable productions of our own country are now applied, new sources of invention, of beauty and art, of profitable industry, of individual comfort, of private and national wealth, have opened themselves to our view, altogether astonishing in their magnitude and effects upon the commerce and happiness of the world.

Of these, perhaps none afford a better illustration of the importance and magnitude of the blessings which God has conferred upon us through his vegetable kingdom, than the simple COTTON PLANT, which, by your invitation, I make the subject of my essay this evening.

The early history of the cultivation and manufac-

ture of cotton, is involved in much obscurity. The shrub or plant which produces it, of which there are several varieties, has been found growing spontaneously or successfully cultivated, in nearly all the countries of the globe, situated between 40 degrees North, and about 33 South latitude. In "the Crimea" it is grown as far North as 43 degrees of latitude, and under the torrid zone in South America, on mountains 4,000 feet elevation above the level of the sea.

It is said to be mentioned but four or five times by the early Greek and Latin authors, and is not alluded to in the Bible. The first mention of it in history is by Herodotus, in his description of the usages of the people of India. Among other remarkable things which he describes, he relates "that the people of that country possess a kind of plant, which instead of fruit, produces wool, of a finer and better quality than that of sheep, and that of this they make their clothes."

The cultivation and manufacture of cotton began in India long before the date of authentic history. At the commencement of the Christian era, they had extended to Persia and Egypt.* It had also begun to be

* In the time of Pliny, A. D. 50, the cotton plant had come to be extensively known. He often mentions it. In his Natural History the following passage occurs:—"In Upper Egypt, towards Arabia, there grows a shrub which some call gossypium, and others Xylon, from which the fabrics are made which we call *Xylena*. It is small, and bears a fruit resembling the filbert, within which is a downy wool that is spun into thread. There is nothing to be compared to these stuffs for whiteness and softness; beautiful robes are made from them for the priests of the land."

Mr. John Chapman, in his work recently published on the "Cotton and Commerce of India," says:—"The cotton fibre is the fruit of plants of different forms and magnitudes, from an annual creeper to a tree twenty feet in height: only the kinds produced by annual, triennial, and perennial bushes are used for woven manufactures. * * * * The kind commonly, and perhaps from ancient times, produced and used in India, differs from the sorts ob-

used in Rome. As early as 63 years before Christ, Lentullus made use of cotton cloth as an awning for the theater; and frequent mention is made of it by the writers of that and later periods.

The commercial activity of the early followers of Mahomet widely spread its use in their day.* Science and every kind of industry were carried to greater perfection in Spain, under the dominion of the Moors, than they attained at that period in any other part of Europe; and the manufacture of cotton into various and beautiful fabrics flourished in that country under their dominion; yet the mutual repugnance existing between the Mahometans and Christians, was doubtless the cause that prevented its spreading to other parts of Europe.

tained in other countries, and seems even from the days of Arkwright to have been held in inferior estimation in England, although its substantial good qualities give it a decided preference with the natives, who use it."

Not many years since, one traveler (Mr. John Duncan), found a variety of the plant in Abomey, Africa, which produced a very superior cotton. The stocks of the plants were fourteen feet high, with large branching heads.

E. H. Hopkins, Esq., our present consul for Paraguay, informs us, that upon the alluvial banks of the large streams of that country, cotton of superior quality is grown, and that in the forests are found two kinds of wild cotton, admirably adapted to the manufacture of paper.

* It is stated upon good authority, that Omar, the immediate successor of Mahomet, preached in a tattered gown of *cotton*, torn in twelve places. Another evidence that it was common in Mahometan countries, may be seen in the observation of two Arabian travelers who visited China in the ninth century. They remarked, "that the Chinese chiefly used silk stuffs for their garments, nstead of cotton, *as the Arabs did.*"

It is also stated by William de Rubruquis, who was Ambassador from the French King to several oriental courts in 1252, that cottons were then articles both of trade and costume in the Crimea, and southern Russia; being brought from Turkistan, and that they were worn to some extent in the provinces of Tartary.

In the fourteenth century the manufacture of cotton had been carried to great perfection in Granada. Abu Alkhatib, the Spanish Arabic historian of that kingdom, affirms that cotton garments made there were said to be far superior in delicacy and beauty to those of Assyria.

But when after years of bloody warfare, Granada, the last stronghold of Moslemism, fell before Ferdinand, science also fell, the arts were lost, and "Woe is me, Alhama," was truly a more significant sigh than the heart-broken words express. Barcelona, however, continued the manufacture. In 1560, fustians were made in great quantities at Bruges and Ghent. Antwerp at this period imported fustians from Venice, and also many finer qualities of fustians and dimities from Milan. In Italy, Germany and Flanders, the manufacture had but a lingering and ignoble existence; and indeed it was not then carried to any degree of perfection anywhere in Europe.

Paper was first made of cotton by the Chinese, and a knowledge of this art was brought from them into Europe by the Saracens. Although the plant had been long known in China, yet cotton cloth was rarely manufactured by that people until after the conquest of their country by the Tartars; but as early as 1368, its use prevailed throughout that empire.

The precise date when this manufacture commenced in England, is not known. From an entry in the books of Bolton Abbey, 1298, it is stated that "cotton wsa used for candle-wicks;" but no advance was probably made during the three succeeding centuries of war, ignorance, and confusion.

In an old work entitled the "Process of English Policy," the author says, "Genoa resorts to England in her huge ships, called Carracks, bringing many commodities, as silk, paper, wool, oil, COTTON, &c." This was near the close of the fifteenth century.

England from that period had her cotton from

Cyprus, Smyrna, and other countries bordering on the Mediterranean, until the establishment of her great East India and American trade.

Woolen goods had long been manufactured in England, when in 1585, on the capture of Antwerp by the Duke of Parma, large numbers of Protestant artisans fled from the cities of the Spanish Netherlands, and took refuge in England, bringing with them the art of manufacturing cotton: some of them settled in Manchester, and were encouraged by the warden and fellows of the College of that town.*

Down to the year 1530, no essential improvement had been made in the machinery for spinning and weaving, beyond the ancient distaff and spindle, and primitive loom. In this year, the common one-thread spinning wheel was invented at Brunswick, in Germany. The "weaver's," or "Dutch loom," was brought into use in London, from Holland, about the year 1676. It was similar in construction to our common hand-loom. We have no record of the invention of the primitive loom, nor by whom it was brought to this stage of improvement.

Columbus found cotton growing wild and in great abundance in Hispaniola, and other West India islands. And the splendid stuffs sent by Cortez to Spain after his conquest of Mexico, is satisfactory evi-

* "At so late a period as the year 1331, weaving was so little understood in England, that the arrival of two weavers from Brabant is recorded as among the important events of the time. But it was the religious persecutions of the Duke of Alva which first gave importance to the manufacture of cloth in England, by driving crowds of Flemish weavers to seek a home in that country. Louis the XIV., by his revocation of the edict of Nantz in 1686, caused the expulsion from France into England, of about 50,000 of the best French manufacturers."—URE.

dence of the high state of perfection to which the Mexicans had carried the art of manufacturing. Yet they had made no advances in machinery beyond the distaff, spindle and primitive loom.*

In 1641, a little English work, called the "Treasure of Traffic," notices the new art, as if it had then become well established at Manchester; supplying not only the market at home, but also those of the Levant, in exchange for the raw material. Still, *linen* yarn

* "There is no doubt that in Greece, Troy, Tyre and Sidon, the arts of weaving, dying and embroidery, had been carried to a high degree of perfection at the time of the Trojan war.

"The Indian loom was probably the same four thousand years ago as now. It was simple and rude in its construction. The mode of operating the ancient loom differed among different nations. Herodotus says:—'The Egyptians shoot the woof beneath, and other nations above.' This proves that they operated their looms differently, but I do not clearly understand his meaning. The Hindoo loom is thus described by modern writers:—'It consists merely of two bamboo rollers, one for the warp and the other for the web, and a pair of geer. The shuttle performs the double office of shuttle and lathe, and for this purpose, is made like a large netting-needle, generally of a length somewhat exceeding the breadth of the piece. This apparatus the weaver carries to a tree, under which he digs a hole large enough to contain his legs and the lower part of the geer. He then stretches his warp by fastening his bamboo rollers at a due distance from each other on the turf by wooden pins. The balances of the geer he fastens to some convenient branch of the tree over his head, two loops underneath the geer, in which he inserts his great toes, serve instead of treadles, and his long shuttle draws the weft through the warp, and afterwards strikes it up close to the web. The reed used by them is like our own, and well made."

In the old pictures of the Aztec machinery that have been discovered, neither the shuttle nor distaff have been found represented, and these were probably not attained by that people. According to the accounts of modern travelers, the Aztec loom was a very rude instrument, consisting merely of four stakes driven into the ground, upon which the web was stretched; no shuttle was employed by them, but in place of it a long wooden needle; no attempts, it would seem, were made by them to render their implements more efficient. The modern Peruvians spin without the distaff, and their loom is like the one just described. Every piece of cloth was woven the precise width wanted for a garment. Specimens of the cloth have been found in their tombs.

was used for the warp of fustians and nearly all other cotton goods, down to the year 1773. Rudeness of machinery prevented the production of fine yarns or fine fabrics. Dimities were woven, but no calicos were attempted.

Towards the close of the seventeenth century, a great increase of the manufactures and trade of England took place.

During the period of almost uninterrupted peace between 1720 and 1740, the commercial towns, and especially Manchester, made rapid strides in wealth, population, and manufacturing operations; the grand staple being cotton in all its varieties.

At this time the demand for yarn exceeded the supply, and the weaver was continually pressing on the spinner. The Manchester merchants began to give out linen warps and raw cotton to the weavers, receiving them back in cloth, paying for the carding, roving, spinning and weaving. When finished, the cloth was dyed by the merchants, and then carried by them to the principal towns on packhorses, to be retailed to shopkeepers along their route.

The great expense necessarily incurred in converting cotton into yarn on the single thread wheel, and the small quantity that could be produced in a given time, formed a great obstacle to the increase of the new manufacture.

In 1738 Mr. John Kay, a native of Bury, in Lancashire, and a resident then of Colchester, invented the "Fly Shuttle" which is still in use. By this new invention, the shuttle was driven across the warp and back again without being thrown by the workman's hands.

By this means the weaver was enabled to make nearly double the quantity of cloth, and, besides, *one man could weave the widest web.*

About this time Mr. John Wyatt of Litchfield or Birmingham invented a machine for spinning cotton *by rollers*, and two factories were established employing his machinery, one at Birmingham and the other at Northampton. Both the undertakings, however, failed; and the machines were long since lost, no models of them remaining now in existence.

The patent for this machine was taken out in 1738, in the name of Lewis Paul, a Swede, who was connected with Wyatt in business.

Paul took out another patent for spinning by rollers in 1753. It is highly probable the machine was the same as the machine of 1738, but included a supposed improvement in the mode of applying the sliver of cotton to the rollers, consequent upon his improvement in the carding process hereafter to be described.

No other attempts to spin by machinery are known to have been made till 1764.

The fly shuttle also of Mr. Kay was not brought into general use until 1760; when his son Robert invented the *drop box*, which enabled the weaver to use any one of three shuttles containing different colors without removing and replacing them in the lathe. These inventions excited the envy and hatred of the ignorant weavers of Lancashire, and were so maliciously opposed by them, that Mr. Kay left the country, taking up his residence in Paris.

The numerous and remarkable inventions which were made soon after this period, are differently re-

corded by different authors. Having examined many conflicting accounts, I believe the following to be their correct history:

The first spinning machine produced after the failure of Wyatt's, was contrived by Thomas Highs, assisted by a Mr. Kay, clock maker of Leigh, in Lancashire, and named for his daughter Jane, "*The Spinning Jenny.*" It was, however, an imperfect machine, wanting many parts essential to its success. Highs afterwards produced a double Jenny with some new apparatus, for which he received a present of 200 guineas from the manufacturers of Manchester. But it does not rest on any conclusive evidence that he was an original inventor. He continued to make Jennies, mostly on his own plan; till he was disabled by a stroke of palsy, about 1790.

The great demand for yarn, which the one-thread wheel could not supply, made many persons endeavor to contrive a substitute for the imperfect hand machine.

A "Society for the Encouragement of Arts, Manufactures, and Commerce," was established at Manchester, England, in 1754. In the nine years succeeding, six model machines had been presented for approbation, and the society had distributed £544 12s. in premiums for improving several machines used in manufactures, viz: the comb-pot, cards for wool and cotton, stocking frame, loom, machines for winding and doubling, and *spinning wheels*.

In the transactions of the Society in 1783, it is said by the compiler: "From the best information hitherto obtained, it appears that about the year 1764 a poor man, of the name of HARGREAVES, employed in the cot-

ton manufactory near Blackburn in Lancashire, first made a machine in that county which spun eleven threads, and that in the year 1770 he obtained a patent for his invention. The construction of this kind of machine, called a Spinning Jenny, has since been much improved, and is now at so high a degree of perfection, that one woman is thereby enabled with ease to spin a hundred threads of cotton at a time." James Hargreaves, a weaver of Standhill, near Blackburn, was the author of the above invention, the date of which has however been supposed 1767. This invention of Hargreaves showed high *mechanical genius;* and, differing completely from any machines that had been produced before, *there can be no doubt of its originality.*

The inventor is said to have received his first idea of it from observing that a one-thread wheel having been overturned upon the floor, both the wheel and spindle continued to revolve. Hence, it occurred to his mind, that if a number of spindles were placed upright and side by side, several threads might be spun at once.

This invention of Hargreaves, thus suggested to his mind by an awkward accident, was the first efficient advance from the common one-thread spinning wheel, and may justly be regarded as the prototype of all the wonderful improvements in the art of spinning, which have since been made. This machine he first kept as secret as possible, confining it solely to the yarn which his family spun for his own weaving. At length it became known, and the spinners raised a cry against it, alleging it would throw multitudes out of employment. A mob broke into Hargreaves' house and destroyed the

machine: not only this, but the persecution he suffered, and the danger in which he was placed, obliged him to leave his native county, as the inventor of the "fly shuttle" had been compelled to do before him. He retired to Nottingham in 1768, where, in partnership with Mr. Thomas James, a joiner, he erected a small mill. Before he left Lancashire, he had made a few jennies for sale; but although the manufacturers and weavers fully appreciated and encouraged their use, a desperate effort was made by a mob in 1779, to put down the machine. Not only the jennies but all the machines turned by water or horses, were destroyed for several miles around Blackburn; those jennies only were spared which contained but twenty spindles, these being admitted by the mob to be useful. Hargreaves died at Nottingham in 1778, having maintained his family in comfort by the fruits of his invention.

The inventions and improvements I have described, were, however, but the first dawnings of a new era in the history of mechanical contrivances. The idea of a complete system of manufacturing with the aid of labor-saving machinery, had not yet been conceived by the mind of man. It was reserved for RICHARD ARKWRIGHT to introduce and establish a system which has placed England in wealth and commercial greatness at the head of the nations,—*which has materially affected the destinies of our own country, and changed the commerce of the world.*

RICHARD ARKWRIGHT was one of those great characters whom nature seems to have destined, by the endowment of superior powers, to be the benefactor of their fellow-men. He was born at Preston, in Lan-

cashire, the 23d of December, 1732, of poor parents: being the youngest of thirteen children, his parents could only afford to give him an education of the humblest kind, and he was scarcely able to write. He was brought up to the trade of a barber at Kirkham and Preston, and established himself in that business at Bolton, in the year 1760. Having discovered or become possessed of a chemical process for dying human hair, which in that day was of considerable value, he traveled about collecting hair, and again disposing of it when dyed.

In 1761 he married a wife from Leigh; and the connections he thus formed in that town are supposed to have afterwards brought him acquainted with High's experiments for making spinning machines. He manifested a strong predilection for mechanics, which he is stated to have followed with so much perseverance, as to have neglected his business and injured his circumstances. His natural disposition was ardent, enterprising, and stubbornly persevering. In 1767, being then 35 years of age, he fell in with "Kay, the clockmaker," at Warrington, whom he employed in relation to some of his mechanical experiments; and it is said he was then endeavoring to produce a perpetual motion. The result of this acquaintance was, that Arkwright devoted himself to a more useful and practicable scheme, and having engaged Kay to work for him in those details which he was not himself skilled in, *he began the construction of his spinning machine.* He had many difficulties to contend with; Kay was unable to make all the machinery required; but Mr. Peter Atherton lent Kay a smith and watch-tool

maker, to make the heavier part of the machine, and Kay undertook the clockmaker's part of it, and to instruct the workmen. *Thus was Arkwright's first spinning frame made.*

Still, poverty did not allow him to prosecute his invention; and he repaired to his native place, where he interested a friend, Mr. Smalley, in his behalf; and his machine was fitted up in the parlor of the house belonging to the "Free Grammar School," which was lent by the head master to Mr. Smalley for the purpose.

Riots had taken place in the neighborhood of Blackburn on the invention of Hargreaves' spinning jenny, as before noticed; and Arkwright, fearing similar outrages against his machine, left Preston, accompanied by Mr. Smalley and Kay, and went to Nottingham.

They first applied for pecuniary aid to Messrs. Wright, bankers, but by them they were referred to Mr. Need, who, with his partner, Mr. Strutt, the improver of the stocking frame, joined Arkwright in partnership. *The machine was made practicable; and in* 1769 *he ~~out~~ took* out *a patent*, describing himself, in his application for it, as Richard Arkwright, *Clockmaker.*

He and his partners erected a mill at Nottingham, which was driven by horses; but this mode of turning the machinery being found too expensive, they built another mill at Cromford, in Derbyshire, on a much larger scale, which was turned by a water wheel, and hence the spinning machine was called the "*Water Frame.*"

By the two important inventions of which I have traced the history, the cotton manufacture was freed

from those obstacles which had hitherto retarded it. The yarn turned off by the new machines was in greater quantity and superior quality; and the hard, firm thread spun by the "*water frame*" being found suitable for warps, linen yarn was abandoned for that purpose, *and goods were for the first time in England, woven wholly of cotton.* More delicate fabrics were also introduced—especially calicoes, in imitation of the Indian. The jenny was peculiarly adapted for spinning filling, so the two machines aided each other.

Arkwright had to encounter much animosity and uncertainty at the beginning of his career. It was not until upwards of five years had elapsed after obtaining his patent, and more than sixty thousand dollars had been expended in machinery and buildings, that any profit accrued to himself and partners.

The Lancashire manufacturers refused to buy his yarns, and he and his partners found themselves encumbered with a heavy and valuable stock. They were driven to attempt the manufacture of this for themselves, first in stockings, which succeeded; and then in calicoes, which succeeded also. Another still more formidable difficulty arose; the orders for goods which they had received being considerable, were unexpectedly countermanded; the officers of the excise refusing to let them pass at the usual duty of 3d. per yard, insisting on the additional duty of 3d. per yard as being calicoes, though manufactured in England.

By this unforeseen obstruction a very considerable stock of calicoes accumulated. The proprietors, therefore, had no resource but to ask relief of the Legislature; which, after much money expended, and against

a strong opposition of the manufacturers in Lancashire, they obtained.

This was the first Legislative acknowledgment of the existence of a British manufacture consisting wholly of cotton, and was in 1774.

The cotton machinery was still very imperfect, especially in the preparation; and the process of *carding* was the next subject for improvement. This was done with hand cards, which were made about 12 inches long and 5 wide: the cotton being spread upon one of the cards, it was repeatedly combed with the other till all the fibres were laid straight, when it was stripped off the card in a fleecy roll, ready for the rover. The first improvement was in making one of the two cards a fixture, and increasing its size, enabling one workman to do double the quantity of work; and this was rendered still more easy by suspending the movable card by a pulley from the ceiling, with a weight to balance it, so that the workman had only to move the card without sustaining its weight. These "stock cards," as they were called, had been used in the woolen manufacture, *but they were applied to cotton* by Hargreaves, in 1760. The grand improvement in carding (as in fact in all other machinery) was the application of *rotary motion;* and this we owe to Lewis Paul, before mentioned, who took out a patent for his machine in 1748. This invention was admirable, but it had defects: the cotton was put on and taken off by hand, requiring the stoppage of the machine; and the perpetual carding was also done by the hand, joining short lengths together. These defects were remedied by a *feeder*, which was invented by John Lees, of Manchester in 1772; and

a continuous fleece was produced by the contrivance of Messrs. Wood and Pilkington.

In 1775 also, Arkwright took out a patent for a carding machine containing many improvements; the patent also included machines for drawing and roving. Cylinder cards were invented about 1762, and were first used by Robert Peel, ancestor of the late distinguished prime minister of England. Carding was not perfected, however, until 1775, the date of Arkwright's patent. The machines just mentioned as patented by Arkwright, are very important; and good yarn could not be spun by machinery without them. The machines have been greatly improved since, and some others introduced; but Arkwright was the first to introduce the *drawing process*, and to apply the spinning rollers to the purpose of *roving, and very great merit belongs to him on that account.*

But there are three machines I have not mentioned, which are used previous to the operation of carding, equally useful with the important inventions I have described, in forming a complete series of machinery adapted to the manufacture of cotton. From the very hard pressure to which cotton is subjected in packing, it is in matted lumps, mixed with more or less of dirt, leaf, &c. The first process to remedy this is by means of a machine called a "Willow." This name is derived from a machine which had been formerly used in Normandy for cleaning cotton and probably sheep's wool. It was a cylindrical cage made of *willows*, with a rotary axis and cross arms. The machine used now is entirely different, but it retains the name. After passing

through this machine, the cotton was taken to what was then called the *scutching machine*, in which it was beaten by metallic blades revolving on an axis with great rapidity. This machine was introduced into Manchester about 1808. Before the invention of it, the cotton was opened and cleaned by being placed upon cords stretched on a wooden frame, and then beaten by women with smooth switches. The third machine is the spreading or lapping machine, constructed and brought into use by Messrs. Arkwright and Strutt.

They had thus perfected a *complete series of machines*, which were capable, at a small cost and without *the aid of human strength* (except carrying the material from one machine to another), of performing all the operations which were requisite and necessary for converting the "*Vegetable Wool*," which excited so much the admiration of the "*Venerable Father of History*," into yarns ready for the weaver's use. *These inventions commenced with Wyatt and Paul in* 1733, *and were the joint results of many profound minds directed to the same object; but the merit of combining them all to form a perfect whole, belongs to* RICHARD ARKWRIGHT, the poor barber of Preston.

When this admirable series of machines became known, Arkwright's fame resounded in all quarters, and his machines were eagerly sought and used. The consequence was an unlimited supply of yarn to the weaver, cotton warps at a lower price than linen, cotton fabrics at very reduced prices, and consequently a great demand, *and high wages to the weavers;* spinning mills were erected upon a large scale by Arkwright and

others, *and a mighty impulse was given to the cotton manufacture.*

*The factory system in England, as applied to cotton, takes its rise from this period.** Hitherto, the various operations being performed separately, had been carried on entirely in the houses of the workmen, or adjacent workshops. But the machines of Arkwright required more space than the dwellings of the workmen could afford, and more power than could be given by the human arm; their weight also was great. These circumstances, added to the consideration of waste, and the necessity for water power (*the only motor then known*), led to the erection of mills, in which every separate process might be carried on without the waste and trouble of moving the material from house to house.

Meanwhile, Arkwright's success and the wealth that rapidly flowed in upon him, roused the jealousy of other manufacturers, and several persons set up machines similar to his without his license, on the plea that he was not really the author of these inventions. To vindicate his claim he instituted actions, which were defended by an association of Lancashire manufacturers. Only one action came to trial, and a verdict was given

* "From Homer we learn that embroidery and tapestry were prominent arts with the Thebans, that poet deriving many of his pictures of domestic life from the paintings which have been found to ornament their palaces. Thus, it is evident that some of the proudest attainments of art in our own day, date their origin from a period coeval at least with the Iliad. Again, we find that the use of the distaff and spindle, referred to in the Sacred Scriptures, was almost as well understood in Egypt as it now is in India; while the *factory system*, so far from being a *modern invention*, was in full operation, and conducted under patrician influence, some three thousand years ago."—[*Pastoral Life and Manufactures of the Ancients.*]

for the defendant, thus setting aside his patent. In another attempt to establish his second patent, Arkwright gained a verdict. But the Lancashire manufacturers obtained a writ from the Lord Chancellor to try *the validity of the patent.* The cause was ably argued, models exhibited, and numerous witnesses examined; *a strong case was made out against him, and the patent was set aside. Thus were his machines thrown open to the public, and an astonishing extension of the manufacture immediately ensued.*

It would consume too much time to follow the personal history of *this extraordinary man;* but his life is well worth studying, for the example which it affords of unwearied ardor and industry, even after fortune had poured her golden store so amply upon him. He endeavored at fifty years of age to remedy the defects of his early education; and his economy of time was a marked feature in his character to the last moment.

In 1786 he was appointed high sheriff of Derbyshire, and soon after received the honor of Knighthood, from George the Third. He died at Cromford on the 3rd of August, 1792. in the sixtieth year of his age. He left an immense estate, and his descendants are now among the wealthiest of the commoners of England.

But Hargreaves' and Arkwright's machines were not adapted to the finer qualities of yarn. This defect was remedied by the invention of another machine, which was named the *Mule*, from its combining the principles of Arkwright's water frame and Hargreaves' jenny. This admirable invention, *which has entirely superseded the jenny*, and to some extent the water frame, was contrived by Samuel Crompton, a weaver

of respectable character and moderate circumstances, living at "Hall-in-the-Wood" near Bolton. He was but 21 years of age when he commenced his undertaking, and was five years in bringing it to maturity, which was accomplished in 1779. In his account of his invention he said, "he had no other end in view than having good yarn to weave." The unambitious man took out no patent, "desiring merely to enjoy," what he termed "his little invention, in his own garret." The very superior quality of his yarn, however, raised public curiosity as to the method by which it was produced, and persons came to him from all quarters to inquire respecting it.

Thus, the machine became known, and was turned to advantage by more energetic manufacturers, while the modest inventor received no other recompense than the very inadequate one of £5,000 granted him by parliament in 1812. The first mule made by Crompton was rude and heavy; but an ingenious mechanic, Henry Stones of Horwich, who had doubtless seen Arkwright's machine, constructed a mule in a workmanlike manner, making the rollers of metal, and applying clock work to move them; and adapting it to three times the number of spindles Crompton had used. Other persons made other improvements; and in 1790, *the mule was first turned by water power, by* MR. KELLY *of Lanark Mills.*

The superior quality of yarn produced by the mule, created a great demand for laborers to operate it, and consequently a much higher rate of wages than was paid to artisans in general. This led to frequent combinations for higher wages on the part of workmen

who were capable of operating the machines, which naturally led to an anxious desire on the part of the proprietors of cotton mills, that some means should be devised to enable them to dispense with the labor of the spinners.

Various attempts, running through a period of twenty or twenty-five years, were made by different mechanicians. The only persons who succeeded beyond the purposes of experiment, were, Messrs. Eaton, De Jough, Buchanan, Brewster, Roberts, and Knowles. But these were generally unsuccessful, from defects in the adjustment of the machinery and various other causes. James Smith of Scotland invented a self-acting mule which operated successfully, and which was introduced and patented in this country, as I shall hereafter describe when I come to speak of the United States.

But the machine which has met with decided success is the "*self-acting mule*," invented by Mr. Roberts of the firm of Sharp, Roberts & Co., of Manchester, which is now in extensive use in England and has been introduced into the United States. Mr. Roberts took out his first patent in 1825; and a second, for a further improvement, in 1830. A description of this extraordinary and intricate machine cannot be given without diagrams. Many improvements have also been made in the different machines used by Arkwright, which it would take too much time to name; among others, is the throstle frame, the ring spinner, and Danforth's cap spinner, which have taken the place of Arkwright's water frame. This brings the invention of spinning machinery to about 1833; since which time *our own coun-*

try has furnished more improvements than any other, and has imparted more than it has received.

Such rapid progress in the spinning department of the cotton manufacture, demanded a correspondent improvement in that of weaving. A loom moved by water power had been contrived by M. De Gennes, in the 17th century, but it is not known to have come into use. About the middle of the 18th century a swivel loom was invented by M. Vauconson; and in 1765, a weaving factory, probably filled with these looms, was erected by Mr. Gartside of Manchester; but no advantage was realized, as a man was required to superintend each loom.

In 1785, the Rev. *Dr. Edmund Cartwright* invented a power loom, which may be regarded as the parent of that now in use. His first attempt, by his own description, was an awkward affair. He says, "The warp was placed perpendicularly, the reed fell with at least four hundred pounds weight, and the springs which threw the shuttle were strong enough *to have thrown a Congreve Rocket.*" It required the strength of two powerful men to work the machine at a slow rate, and only for a short time. He, however, made improvements, and took out another patent, the 1st of August, 1787, but was unfortunate in a weaving factory, which he established for weaving with power looms. He, however, received £10,000 from parliament as a reward for his ingenuity.

After the failure of his first factory, another establishment, containing 500 looms, built at Manchester, was destroyed by an exasperated mob, in 1790, under the delusive idea that the introduction of weaving ma-

chines would do away with the demand for their labor, and destroy their means of subsistence. The invention, nevertheless, was improved by others, and surmounted all opposition. At the time of Cartwright's death, in 1824, it was stated that *power looms* had increased so rapidly in England, that they were then performing the labor of *two hundred thousand men.*

In 1794, a power loom was invented by Mr. Bell of Glasgow, but it was abandoned. In 1796, Mr. Robert Miller of Glasgow also took out a patent for a machine of this nature; which was adopted in 1801, by John Monteith of Glasgow, who fitted up a mill with 200 looms. It was several years, however, before the business was made to answer.

But it was not till Mr. Horrocks, of Stockport, in 1803, after a long career of costly experiments, introduced some very important modifications into the power loom, that it became effective; but unfortunately omitting certain minutiæ in the construction, which interfered with its uniformity of performance, he did not receive the reward which was due to his talents and ingenuity. But his loom is essentially the one now in use. It was perfected by Messrs. Sharp and Roberts.

The great obstacle to the success of the power loom was, that it was necessary frequently to stop the machine, in order to dress or size the warp as it unrolled from the beam. This difficulty was removed by the invention of a machine for dressing the warp before it was placed in the loom. This *beautiful and valuable* machine, was invented by Messrs. Radcliffe & Ross, of Stockport, assisted by a workman of the name of

Thomas Johnson. They spent two years in experimenting before the machine was produced. They obtained a patent for it in 1802. Passing over many valuable inventions for manufacturing cotton—not the least of which is the stocking frame for weaving hosiery, invented by *Wm. Lee*, of Nottinghamshire, in 1589, and greatly improved by *David Holt*, and afterwards by that accomplished man, JEDEDIAH STRUTT, who first wove *ribbed* stockings, in 1756—and also the contrivances of machines for weaving lace, I will describe very briefly the improvements in bleaching and the introduction of calico printing.

Bleaching by the action of the sun and atmosphere is the most ancient, and still the common method in many countries. But this process is too slow to suit the modern demands of manufacturers. The bleaching process, as performed in the middle of the last century, occupied from six to eight months. "It consisted," says the "Encyclopædia Britannica," "in steeping the cloth in alkaline lyes for several days, washing it clean, and spreading it on the grass for some weeks: this operation was repeated five or six times. The cloth was then steeped for some days in sour milk, washed clean, and dried. The processes were repeated, diminishing every time the strength of the akaline lyes, till the cloth had acquired the requisite whiteness." In the last century the art of bleaching was so little understood in Great Britain, that nearly all the linens made in Scotland were sent to Holland to bleach. From this came the name of "Hollands," as applied to this species of British manufacture.

The first great improvement in bleaching in Great

Britain, was made about the middle of the last century. Dr. Home of Edinburgh, introduced the use of water acidulated with sulphuric acid, as more powerful than sour milk. By the quicker operation of this liquid, the souring of the cloth was effected in a few hours, instead of occupying days and weeks as formerly; and in the whole process so much time was saved as to reduce it from eight months to four.

A still greater improvement was the result of the discovery of chlorine, or oxymuriatic acid. This powerful chemical agent was discovered by Scheele, a Swedish chemist, in 1774, who observed its property of destroying vegetable colors, from its having bleached the cork of his phial. This fact became known to Bertholet, a French chemist, to whom the idea occurred of applying it to the bleaching of cloths; and, in 1785, having found by experiment that it answered the purpose, he made known *this great discovery.*

James Watt, the improver of the steam engine, learned from Bertholet, at Paris, the success of his experiment, and introduced it in England with success in 1786. Mr. Henry, of Manchester, also introduced an improvement in 1788, by the addition of lime in order to overcome the noxious smell of the acid. But there were still some objections to the process. Mr. Tennant, of Glasgow, after much laborious investigation, discovered the method of making a saturated liquid of chloride of lime, and produced what is now known as "Tennant's Bleaching Powders"—which was found to answer perfectly all the purposes of the bleacher,—and brought the article into common use. Every thing is now performed by machinery or the use of chemical

agents, and the process of bleaching is reduced to a few days.

The art of *Calico Printing*, though apparently one of the most difficult, has been practiced from a remote era. Herodotus mentions "that a nation on the shores of the Caspian were in the habit of painting the figures of animals on their clothes, with a color formed from the leaves of trees bruised and soaked in water; and he adds, that this color is not effaceable." There is a passage in Pliny, which though somewhat obscure, shows that the Egyptians were fully acquainted with the *principle* of calico printing.

A process, similar to the one practiced by the Egyptians is known to have been followed in India from the earliest times. The chemical and mechanical inventions of modern ages have been the cause of vast improvements in this beautiful art; but in this instance, it appears, the moderns have been only perfecting and improving processes practiced in the remotest antiquity. It is believed that calico printing was not practiced in Europe till the 17th century, and did not commence in England till about 1675, where it is now a very important and valuable business. In the year 1690, an establishment was commenced on the banks of the Thames near London, but the goods there printed were confined to muslins and calicoes imported from India. With a view to fostering and encouraging this branch of industry, the British government passed an act in 1700 forbidding the sale or use of foreign printed goods. And to prevent the use of foreign calicoes interfering with the domestic production of linen and woolen stuffs, an act was passed 1721 imposing a penalty of £5 upon

the wearer, and £20 upon the seller of a piece of calico. Fifteen years after, this statute was so modified, that calicoes manufactured in Great Britain were allowed to be worn, "*provided the warp thereof was entirely of linen yarn*:" in 1774, a statute was passed allowing printed goods made wholly of cotton to be used. And this branch of trade has also been further protected by several subsequent acts, as in 1782, prohibiting the exportation of any materials used in printing, &c., and in 1783, giving bounties on the export of British printed goods; and several other statutes were enacted on the same principle until 1787, an excise duty of 3d, which was afterwards raised to 3½d. was imposed on all printed cottons. But the same was allowed as a drawback on the goods when exported. This act was wholly repealed in the year 1831, mainly through the exertions of Mr. Thompson, afterwards Lord Sydenham.

The old method of printing calicoes was by using blocks of wood, on the surface of which the pattern was cut in relief, like the common method of wood engraving; thus the figure was impressed upon the cloth: only one color could be used at once; and if other colors were required to complete the pattern, it was necessary to repeat the operation with different blocks. This was a slow and expensive method, and required great manual dexterity.

The great improvement in the art was the invention of *cylinder printing*, which bears nearly the same relation, in point of dispatch, to block printing by hand, as throstle or mule spinning bears to the one-thread wheel.

This great invention is said to have been made by a Scotchman of the name of Bell, and was first successfully applied about the year 1785. By subsequent improvements, this method has attained great perfection. At the present time, a piece of cloth containing thirty-five yards, *when everything is properly prepared*, can be printed by the *cylinder machine*, in the best manner with six or eight different colors, in less than five minutes.

The period of the establishment of the cotton manufacture in England, was one of peculiar interest to that nation, and is well worth the serious study of the political economist. At its commencement, she had just lost her American Colonies—retiring from that contest reduced in her national means of aggression and defense to an amount exceeding *one hundred thousand men* and *one hundred millions of money*. The French Revolution and the frightful struggles which followed that event, brought her into collision with the other European powers, which resulted in the continental system of the Emperor of the French, having for its principal object, the humbling of England by the exclusion of her manufactures from the continent. Yet the quiet but ceaseless activity of her spindles and her looms, enabled her to turn these seemingly disastrous events into sources of individual profit and national strength. Her lost colonies became her best commercial customers; and the paralysis upon the manufacturing interests of the continent produced by that very system, gave to her the lion's share in the commerce of the world. The superiority of her marine and her insular position, enabled her to protect her

commerce and manufactures, of which the larger though the newer branch was the *cotton manufacture;* while the profits of the latter enabled her not only to sustain the former, but also, to subsidize her allies, and in the end to conquer her enemies. *The genius of Napoleon was not a match for that of* HARGREAVES, ARKWRIGHT, CROMPTON AND CARTWRIGHT.*

Her manufacturing enterprise would, however, soon have found its limit, had it not been for the perfecting of the Steam Engine by WATT, who in 1785 first applied this motive power to cotton factories.

The following table from De Bow, will show the early progress of the cotton manufacture in Great Britain, prior to the invention of the spinning-jenny by Hargreaves:

Years.	Raw Cotton Imported.
1697	1,979,359 lbs.
1701	1,985,868 "
1710	715,008 "
1720	1,972,805 "
1730	1,545,472 "
1741	1,645,031 "
1751	2,976,610 "
1764	3,870,392 "

The spinning-jenny of Hargreaves went into operation in 1767; and Arkwright's improvement was patented and put in operation in 1769. The influence of these, and other inventions and improvements made afterwards, on the manufacture and trade, may be seen by inspecting the following table:

* Of cotton goods alone, the exports of England, between 1793 and 1815, amounted to TWO HUNDRED AND FIFTY MILLION POUNDS STERLING!

Years.	Cotton Imported.
1781	5,198,778 lbs.
1785	18,400,384 "
1790	31,447,605 "
1795	26,401,340 "
1800	56,010,732 "
1805	56,682,406 "
1810	132,488,935 "
1811	91,576,535 "
1812	63,025,936 "
1813	50,966,000 "
1814	60,060,239 "
1815	99,306,343 "

The importations of cotton into England, from all sources, since 1816, have been as follows, according to the statement of Messrs. George Holt & Co., cotton brokers at Liverpool:

Years.	Cotton Imported.
1816	93,000,000 lbs.
1820	143,000,000 "
1825	222,000,000 "
1830	261,000,000 "
1835	361,000,000 "
1837	408,000,000 "
1838	501,000,000 "
1839	388,000,000 "
1840	583,000,000 "
1845	721,979,953 "
1850-51	800,000,000 "

In 1830, the exports of cotton goods were about £12,000,000. In 1840, £24,668,618, and in 1850, the total declared value was £28,252,878.

A leading English paper in speaking of the "Great exhibition of the Industry of all Nations," says of the

department devoted to cotton goods,—Though it might not have appeared so attractive to the common observer, *yet to the statesman and political economist, it was preëminently interesting.* The total number of Cotton Factories in Great Britain, is 1,932; containing 20,977,017 spindles and 249,627 power looms. The amount of capital employed, is probably over two hundred and fifty millions of dollars, and the annual product of goods is about the same sum. The motive power in these factories is supplied by steam, representing 71,005 horse power, and water, representing 11,550 horse power. The total number of persons in Great Britain dependent upon this branch of industry for their daily subsistence cannot be much less than one million five hundred thousand, some writers say more than two millions. Soon after the invention of cotton machinery it was introduced among the various nations of the continent of Europe.

In FRANCE, the greatest manufacturing power of Continental Europe, the earliest manufactures of cotton goods date from the latter years of the 17th century.* As early as 1688, we find the importations at the port of Marseilles from the Levant included 1,450,000 lbs. of spun yarn and 450,000 lbs. raw cotton. In 1750, they had increased to 3,831,620 lbs. of the raw material, and 3,381,625 lbs. of yarn.

* For the following facts touching the cotton manufactures on the continent of Europe, I am principally indebted to translations from the Dictionnaire Geographique et Statisque of Adrien Guibert, published at Paris in 1850, and Wilhelm Hoffman's Allgemeine Encyclopedia, published at Leipzig in 1848, kindly furnished me by an accomplished linguist of this city. I have not been able to find later or more reliable statistics.

Spinning frames from the English designs were made at Amiens in 1765; and in 1784 Mr. Martin, of that town, obtained permission to establish a cotton factory. Cotton manufactures in France, did not, however, obtain to any important extent till the beginning of the present century. In 1806 a commission of inquiry reported that "the art of spinning cotton was completely established in France." At the present time her factories are consuming annually about 150 million lbs. of cotton, and are running about 4 millions of spindles.

The French cotton goods stand preëminent for taste. The best of these are made at Mulhausen on the Rhine, where the first printed goods were produced about the close of the 18th century, by Koechlin & Co., celebrated dyers and printers. At that time these goods were considered by the French India Trading Company as an interference with their privileges, and they succeeded in prohibiting the use of them in France. This continued till the French revolution took place; since when the Mulhausen calicoes have attained a world-wide reputation.

The application of chemistry to the arts of bleaching and coloring have produced the most important changes for the French manufacturers. The great discoveries in this science by her distinguished sons have enabled her manufacturers to outstrip all their competitors in dying and printing.

The celebrated Turkey-red color was first applied to *cloth* in 1810, by the Messrs. Koechlins, before named. Those gentlemen have also the honor of discovering, in 1811, the art of *printing* upon Turkey-red, which is

done by printing upon that color with some powerful acid; and then immersing it in a solution of chloride of lime. Neither of these agents alone affects the color, but those parts which have received the acid, on being plunged in chloride of lime are speedily deprived of their dye, and made white by the acid of the liberated chlorine. *This is said to be one of the most beautiful facts in the chemistry of calico printing.*

In addition to their superiority of colors, the French are quite as celebrated for the combinations of them and for the great beauty of their designs. These are so generally recognized that English and American manufacturers are now in the practice of importing and applying them to *their* work. To show the *great* importance attached to these particular branches of manufacturing, it will suffice to state that the French government has established a *public school* for the teaching of the art of designing as applied to cotton and woolen goods, to which every child, however humble, has access, if showing the proper talent.

In Austria the cotton manufacture gives employment the whole year round to hundreds of thousands of individuals; but no other branch is subject to such fluctuations, and these are occasioned in the first place, by the necessity for drawing the supply of the raw material from abroad. The rapid development of the cotton manufacture is shown in the clearest manner by the quantities imported at given periods. On an average of the five years 1843 to 1847 inclusive, they had increased to 403,100 cwt. In the year 1846 they had reached 447,300 cwt. The increase of this manufacture has been sevenfold in the last 18 years. In the

year 1847 the Austrian monarchy contained 206 spinning mills, with 6,125 spinning machines, and 1,421,986 spindles.

The total production in the year 1849, of cotton yarn and twist, was 397,240 cwt. The number of work-people employed directly and indirectly in the spinning mills is about 50,000. In addition to their own production of cotton yarn they import considerable from abroad, mainly from England. Most of their weaving is done by hand looms. The number of hands employed in *cotton weaving* is not less than 300,000.

SWITZERLAND ranks next to England, in comparison with the number of her population, in the production of woven and spun cotton; it is likewise one of the countries that consumes the most. She has in operation more than 950,000 spindles, and manufactures all the numbers up to 250 (English.) The Swiss possess about 250 dying establishments for thread and woven stuffs. The Turkey-red dying establishments are of great renown. The manufacture of printed cottons commenced in this country about the middle of the 18th century. Her first spinning establishment by machinery was erected about the beginning of the present century. During their early stages her manufacturers had every thing to contend against in the shape of French prohibition and *English competition;* but her energy and industry have overcome every obstacle, and they are now firmly established.

BELGIUM in 1844 was running about 420,000 spindles.

Cotton spinning was introduced into SAXONY in the

16th century. The first articles made were cotton scarfs or veils, of about two yards length, and were purchased by Greek Merchants to be sold to the Turks for turbans. In 1650, an article called "Cotton Crape" was the first result of the improvements made in weaving. At that time the weaving was done by men and women at their own houses. In 1774, owing to the importations of English yarns underselling the domestic spinner, corporations were formed and attempts made to introduce English machinery. In 1800, the first spinning machine was built, by an Englishman, named Whitfield In 1813, all Saxony had but 85 spinning frames, and in 1845, she had 500,000 spindles, employing 12,000 hands.

Prussia, *Baden, Wirtemburg and other small German* principalities were using in 1846, about 100,000 bales of cotton, and running 1,000,000 spindles. Their imports of yarns from England are decreasing annually, and their exports of the same article are increasing.

Russia, in 1841, imported about 30,000 bales of cotton, of which about 2,500 were from the United States, 17,500 from England, and the remaining 10,000 bales from India, Persia, &c. During that year she made 32 million pounds of yarn. The cotton from India imported by Russia, is mostly spun by hand, being a very short staple. In addition to the above importation of cotton, she received from other countries 24 million pounds of yarn, nine-tenths of it from England. The portion brought from Central Asia, is of inferior quality and used only for coarse cloths. Russia at that time had 700,000 spindles, and is annually increasing her cotton manufacture.

EGYPT.—As soon as Mehemit Ali obtained sway in Egypt, his powerful mind sought for means to render him independent of foreign powers. He introduced workmen from abroad, and erected immediately the first cotton factory at Cairo on the Nile. At Malta (a place deriving its name from the Maltese operatives employed there), he also built a large factory to operate 200 looms. He experimented with different varieties of cotton, in order to ascertain the kind best adapted to the climate and soil of Egypt.

In connection with these experiments, M. Jumel, formerly a French merchant in the city of New York, introduced cotton seed and gins from the United States, about 1820 and 1821, and succeeded fully in establishing them. In 1828, the Sea Island was planted, and produced an article of good quality, which is still cultivated, and known in commerce as "Egyptian Sea Island."

TURKEY under her present Sultan is making commendable progress in various manufactures, and among them the manufacture of cotton is by no means neglected. At the World's Fair in London, there were exhibited no less than twenty-five varieties of cotton, the product of Turkey, and upwards of one hundred and fifty articles of cotton manufacture, including those combined with gold, silk and woolen, many of which were of great beauty and gorgeousness. Among the more common and useful articles were specimens of cotton duck for sails. But it is impossible at present, to get correct statistics of the manufactures of this empire.

This important manufacture is now on the increase

in the other European States; but I have not been able to obtain sufficiently correct statistics to enable me to state the amount or the degree of perfection to which they have arrived.* The yarns of England are still exported to the continent, to the amount of many millions annually, which are there woven into cloth, principally by hand looms.

China and the East Indies.—It is impossible to procure very reliable data or estimates of the production and consumption of these over-populated portions of the Globe, but enough is known to render it certain that they are vastly greater than of all the balance of the world. Mr. John Chapman, founder and late manager of the Great Indian Peninsular Railway Company, in his work on the Cotton and Commerce of India, remarks that the estimates by various writers of the consumption of cotton in India, range from one thousand millions to three thousand millions of pounds. The average of these amounts is nearly double the greatest crop of cotton ever raised in the United States. China

* Messrs. Du Fay & Co. of Manchester, have published the following interesting table, giving a comparative estimate of the quantities of raw cotton consumed in the principal manufacturing countries, in millions of weight, from 1836 to 1851. (The figures for the United States are much too low.)

	1836.	1840.	1845.	1849.	1851.
Great Britain, (millions of lbs.)	350	473	597	627	648
Russia, Germany, Holland, and Belgium,	57	72	96	160	118
France, (including adjacent countries),	118	157	158	186	149
Spain,	—	—	—	—	34
Mediterranean,	—	—	—	—	12
Countries bordering on the Adriatic,	28	28	38	47	45
United States of North America,	86	111	158	205	158
Sundries,	—	—	—	—	11
Total (millions of lbs.)	639	841	1047	1225	1175

produces annually more than 500,000 bales of the Yellow or Nankin cotton, besides which she imports largely from India.

During the period, Mr. President, of the brilliant inventions and improvements in mechanical contrivances, which have been described, our fathers had no time to devote to such pursuits. They had other work on their hands of still *greater importance.* They were resisting the encroachments of tyranny, organizing military forces, promulgating a declaration of Independence, preparing constitutions, and founding a Republic.

As soon as they had made good their declaration, perfected their constitution, and formed a more *perfect union* (which we trust may last forever), they turned their attention to the arts of peace.

Before describing the rise and progress of cotton manufactures in the United States, the introduction and growth of the raw material claims our attention.*

* The following synopsis of the history of the early introduction of Cotton into the United States, is given by a writer in the Charleston Mercury, which I quote entire :—

On this interesting subject I find the following information in Governor Seabrook's "Memoir on the Cotton Plant," published a few years ago.

"In a pamphlet of the date of 1666, entitled 'A Brief Description of the Province of Carolina, on the Coast of Florida,' the writer, in speaking of the Cape Fear settlements, made only two years before, says,—'They have indigo, tobacco very good, and cotton wool.' Dr. Hewitt, in his historical account of South Carolina and Georgia, while commenting on the introduction of silk into the former, and the products of the earth, for which premiums ought then to have been given to those who should bring to market the greatest quantities of them, alludes particularly to cotton, and after detailing the manner of planting it, remarks that this article, 'though not of importance enough to have occu-

The precise circumstances under which the cultivation began in the Southern States, the time when and the place where it obtained first a permanent footing, are involved in much obscurity. The attention of in-

pied the whole attention of the colonists, might, nevertheless, in conjunction with other staples, have been rendered profitable and useful.'

"In Wilson's account of the 'Province of Carolina, in America,' published in 1682, it is stated that 'Cotton of the Cypress and Malta sort grows well, and a good plenty of the seed is sent thither.' In Peter Purrey's description of the Province of Carolina, drawn up in Charleston in 1731, 'Flax and cotton' are said to 'thrive admirably.' In the journal of Mrs. Pinckney, the mother of General Thomas, and General Charles C. Pinckney, who, as Miss Lucas, when only eighteen years of age, was entrusted with the management of the planting interest of her father, the Governor of Antigua, is the following memorandum: 'July 1, 1739, wrote to my father to-day a very long letter on his plantation affairs—on the pains I had taken to bring the indigo, ginger, cotton, lucerne and casada to perfection, and that I had greater hopes from the indigo than any other.' 'June, 1741, wrote again to my father on the subject of indigo and cotton.'

"It is a well authenticated fact, that in 1736, as far north as the thirty-ninth degree, cotton 'on the garden scale,' was raised in the vicinity of Easton, in the county of Talbot, on the eastern shore of the Chesapeake Bay. About forty years afterwards, it was cultivated in St. Mary's county, Maryland, and in the northern county of Cape May, in New Jersey; also in the county of Sussex, in Delaware.

"Among the exports of 'Charles Town,' from November 1747 to November 1748, are included seven bags of cotton wool, valued at £3 11s. 5d. per bag. In 1754, some cotton was again exported from South Carolina. In 1770, there were shipped to Liverpool three bales from New York, four bales from Virginia and Maryland, and three bales from North Carolina. Before the Revolutionary war, Virginia exported, *communibus annis*, hemp, flax-seed, and cotton, to the value of $8,000. In 1784, an American vessel that carried eight bags to Liverpool was seized, on the ground that so much cotton could not be produced in the United States. In 1785, 14 bags; in 1786, 6 bags; in 1787, 109 bags; in 1788, 389 bags; in 1789, 842 bags; and in 1790, 81 bags, were received in Europe from this country. Of these, 153 bags were sent directly, and a portion of the remainder by the way of Philadelphia and New York, from Charleston. The first bag of cotton sold in South Carolina, was purchased, in 1784, by John Teasdale, from Bryan Cape, then a factor in Charleston. The first bag of the wool exported from that city to Liverpool arrived January 20, 1785, per Diana, and was consigned to Messrs. J. & J. Teasdale & Co."

Gov. Seabrook, in the pamphlet from which the above are extracts, after-

telligent persons must have been called to it before the commencement of the Revolutionary War, as we find the first provincial congress of South Carolina, held in January, 1775, recommended to the inhabitants to raise *cotton;* yet little practical attention was paid to their recommendation. A small quantity only was raised for domestic manufacture. Soon after the peace of 1783, its cultivation spread, and Georgia took the lead in its production. Among the planters who raised cotton upon a large scale (as it was then called), was Mr. Teake of Savannah: in 1788 his crop was 5,000 pounds in the seed.

The commencement of the cultivation of sea-island cotton is more clearly ascertained.

Some of the colonists who adhered to the royal

assigning very satisfactory reasons for his belief that the seed of short staple cotton was originally introduced into this country from the Mediterranean, says, "Peter Purrey is represented to have brought with him among other seeds, that of cotton. This, and a paper of the same material, received by the Trustees for the settlement of Georgia, from Phillip Miller of Chelsea, England, it can scarcely be questioned, were from the Mediterranean." Mr. Wilson, already quoted, says expressly that the Carolina sort was from Cyprus and Malta. In a pamphlet entitled "American Husbandry," published in London, in 1775, the writer remarks, that "the cotton cultivated in our colonies is of the Turkey kind. On the other hand, it must be supposed, from the language of their historian, that the Cape Fear emigrants, who began the growing of the gossypium only two years after they had established their settlements, were provided with seed from Barbadoes."

In reference to sea island or black seed cotton, the writer states that it "began to be raised in Georgia in experimental quantities, in 1786." The native place of the seed is believed to be Persia. It is designated the Persian cotton by Bryan Edwards, and is so called in the West Indies and by the merchants of England. The seed grown in this country came from the Bahama Islands, where it had been introduced by the Board of Trade, from Anguilla, a small island in the Carribean sea, and was sent by Mr. Tatnall, then Surveyor General of the Bahamas, Col. Relsell, and others, to Governor Tatnall, James Spalding, Richard Leake, and Alexander Bisset, all of Georgia.

cause, had fled to the Bahama Islands; and learning that the inventions of machinery in England had caused a great demand for raw cotton, they were induced to turn their attention to its cultivation. The small island of Anguilla, in the Caribbean Sea, was celebrated for its excellent cotton (the seed supposed to have come originally from Persia); and from thence the Bahama settlers received their seed. By the year 1785, they had succeeded in raising cotton on two of the islands; from one of which Mr. Spalding, of Georgia, received a bag of cotton seed: other Georgians also had similar contributions from their former acquaintances in that colony. From this seed all the Sea Island Cotton plants have been produced.

The species of cotton first introduced, known in commerce by the name of "upland," adheres to every part of its seed with great tenacity: the infinite delay and trouble attending the separation of the fibre from the seed, greatly retarded the extension of its growth. Among the early cultivators, the fibre was usually separated from the seed by the hands of laborers. Rollers and the bow-string were subsequently introduced, but the process with their assistance was exceedingly slow and expensive. From this process the upland cotton took the name in the English market of "Bowed Georgia," and it is now sometimes quoted by that name, although the instrument has been entirely out of use more than fifty years.

Unless some other means could be devised for preparing the cotton for market, all saw that the amount produced, must be very small.

The machine for effecting this desirable object was

invented by ELI WHITNEY, a native of Westborough, Mass. He received his education at Yale College, and graduated in the Autumn of 1792. Soon after this, he went to Georgia in quest of fortune, taking with him a New England boy's usual capital, consisting of a good education, a jack-knife and self-reliance. While residing in that State in the family of Mrs. Green, widow of the late Gen. Green, the cultivation of cotton was exciting universal interest in that section of country. Mr. Whitney often heard gentlemen at the house of this lady express their regrets at the want of some economical method of preparing it for market. With a prophetic perception of its invaluable importance, he went to work to invent a machine that should answer the purpose. After many weeks of intense application his machine was completed; and the SAW-GIN was produced. This was in the latter part of the winter of 1793.* Unlike most other important inventions, this machine does not owe its useful qualities to successive improvements of others, but came forth perfect from the hands of the inventor, and remains in all its essen-

* The following well-authenticated incident in the life of Mr. Whitney, as related by himself to the father of a highly respectable gentleman of this city, is well worth preserving, as a striking illustration of the fact, that the most important results often originate in the most trivial and accidental circumstances. Mr. Whitney stated that while walking for exercise one day after dinner, with a toothpick in his hand, and being in deep meditation upon the project of constructing an instrument for separating cotton from the seed, he picked up a boll of cotton which accidentally lay upon the ground before him; and in trying the tenacity of the fibre to the seed, he mechanically separated the one from the other with his tooth pick. The thought flashed upon his mind, that a proper arrangement of *metallic points* so as to be brought in contact with the fibre to the exclusion of the seed, would effect his object. This was his cue, and the invention of the *Saw-gin* was the result.

tial parts, precisely as Mr. Whitney left it. No invention of labor-saving machines has produced as important results as this. The agricultural resources of the cotton growing States "sprang forth with newness of life," and the United States, which before this had not been known as a cotton-growing country, immediately took the lead in the production of this great staple. The cheapness with which the material could now be produced greatly increased the demand, and this country has for many years furnished more than four-fifths of the cotton used by the civilized world.* It is painful to follow further the personal history of this great man. Although his invention benefited his country untold millions, yet he received no adequate compensation. Though depressed by pecuniary embarrassments, no public reward, like the English grants to their successful inventors, soothed the evening of his life. He is dead. No national monument has been erected to his memory expressive of the gratitude of his countrymen for the transcendent benefit his genius has conferred upon them; but private affection has placed

* The following table, derived from Burn's statistics of the cotton trade, exhibits the proportion and actual amounts of cotton annually supplied to England from different parts of the world, on the average of thirteen years, ending 1846.

	Per cent. of the total supply.	lbs. supplied.
From the United States	79¼	380,568,958
" Brazil	4½	21,462,150
" Egypt	2½	12,123,790
" West Indies	1	4,432,777
" East Indies	12¾	61,578,371
	100	480,166,046

upon his tomb at New Haven in Connecticut this inscription:

ELI WHITNEY,

THE INVENTOR OF THE COTTON GIN.

OF USEFUL SCIENCE AND ARTS, THE EFFICIENT PATRON AND IMPROVER.

IN THE SOCIAL RELATIONS OF LIFE, A MODEL OF EXCELLENCE.

WHILE PRIVATE AFFECTION WEEPS AT HIS TOMB, HIS COUNTRY HONORS HIS MEMORY.

BORN DECEMBER 8TH, 1765,
DIED JANUARY 8TH, 1825.

In my researches into the exports of cotton, I find it stated, but am not certain of the authority, that in the year 1770, there were shipped to Liverpool, three bales of cotton from New York, four from Virginia and Maryland, and three barrels from North Carolina; though in 1784, the year after the close of the Revolutionary war, a vessel that carried eight bales of cotton from the United States to Liverpool, was seized in that port on the ground that so large a quantity of cotton could not be the produce of the United States.* In a British work, I find the following statement: Cotton imported from America, in 1785, as follows—one bag

* I have been informed by Gen. Duff Green, that the first shipment of cotton from the United States to England, was from Savannah, by a person named Miller. It was brought from the interior of Georgia in a pocket handkerchief by a woman, and given in exchange for a pound of copperas and a few pins. Mr. Miller was living a few years ago and well-known in Savannah, as "*Cotton Miller.*"

per Diana, from Charlestown; one per Tonyn, from New York; three per Grange, from Philadelphia. Part of these cottons were seized in Liverpool under the impression, *that cotton was not the produce of the United States.* From an official table prepared by N. Sargent, Esq., Register of the Treasury Department, I find [redacted] the value of cotton exported from the 1st of October, 1789, to 30th June, 1851, to be as follows:

STATEMENT OF THE VALUE OF COTTON EXPORTED FROM THE UNITED STATES, FROM THE 1ST OCTOBER, 1789, TO 30TH JUNE, 1851.

Years ending 30th Sept.	COTTON.	Years ending 30th Sept.	COTTON.	Years ending 30th Sept.	COTTON.
1790	$42,285	1811	$9,652,000	1832	$31,724,682
1791	52,000	1812	3,080,000	1833	36,191,105
1792	51,470	1813	2,324,000	1834	49,448,402
1793	160,000	1814	2,683,000	1835	64,661,577
1794	500,000	1815	17,529,000	1836	71,284,925
1795	2,250,000	1816	24,106,000	1837	63,240,102
1796	2,200,000	1817	22,628,000	1838	61,556,811
1797	1,250,000	1818	31,334,258	1839	61,238,982
1798	3,500,000	1819	21,081,679	1840	63,870,307
1799	4,100,000	1820	22,308,667	1841	54,330,341
1800	5,000,000	1821	20,157,484	1842	47,593,464
1801	9,100,000	1822	24,035,058	9 mos. to 30 June, 1843,	49,119,806
1802	5,250,000	1823	20,445,520	Years ending 30th June.	
1803	7,920,000	1824	21,947,401	1844	51,063,501
1804	7,650,000	1825	36,846,649	1845	51,739,643
1805	9,445,500	1826	25,025,214	1846	42,767,341
1806	8,332,000	1827	29,359,545	1847	53,415,848
1807	14,232,000	1828	22,487,229	1848	61,998,294
1808	2,221,000	1829	26,575,311	1849	66,396,967
1809	8,815,000	1830	29,674,883	1850	71,984,616
1810	15,108,000	1831	25,289,492	1851	112,315,317

From this table we see that the total declared value of the exports of raw cotton from the United

States from 1790 to 1851 inclusive, amounts to the immense sum of ONE THOUSAND SEVEN HUNDRED AND ELEVEN MILLION, SIX HUNDRED AND NINETY-ONE THOUSAND, SIX HUNDRED AND SEVENTY-SIX DOLLARS ($1,711,-691,676), and this is exclusive of the large quantity that has been consumed in our own country. There is nothing to be compared to this in the history of commerce or in the annals of human industry. *This perhaps is not the proper place or occasion to indulge in the reflection, as to what the effect upon the resources and development of our own country would have been, had its circumstances been such, or could the policy of the government have been so shaped, that instead of exporting barely the raw material, it could have had its value enhanced by* HOME LABOR, *by manufacturing it into cloth or simply into yarn, before exportation.*

The capital invested in the *culture* of cotton; which has produced the foregoing extraordinary results, was estimated by the late Hon. Levi Woodbury, in his very able report, as Secretary of the Treasury, made in February, 1836, at $740,000,000 permanent, and $30,000,000 floating. Assuming this calculation to be correct, (and the value of lands, &c., and the produce per acre, do not now vary materially from his estimate at that time,) I find that the total amount of capital invested at the present time in this branch of the agricultural industry of the United States cannot vary much from $1,500,000,000.*

* A recent writer says of this report of the late Secretary, that in making his calculations he estimated the number of acres in cotton at 2,000,000, and the annual product at 300 lbs. net cotton per acre. This is entirely too large an estimate of the yield per acre; and consequently he made the number of

The first mention I find of American Manufactures for sale, is from an advertisement in the Pennsylvania Gazette, April 3d, 1782, by SAMUEL WETHERELL, who advertised Jeans, Fustians, Everlastings, Coatings, &c., to be sold *at his manufactory*, in South Alley, between Market and Arch Streets, Philadelphia.

Machinery, other than the one-thread wheel, common loom and hand cards, had not then come into use. In 1786, Mr. Orr, of East Bridgewater, Massachusetts, employed Robert and Alexander Barr, from Scotland, to construct carding, spinning and roving machines. On the 16th of November, 1786, the Legislature of Massachusetts, to encourage the machinists, made them a grant of £200, lawful money. In March, 1787, Thomas Somers, (an English Midshipman,) also constructed a model of a spinning jenny, for which he received £20, lawful money, from the State Government. The above machines and model, remained in Mr. Orr's pos-

acres too small, and the production too large. By the best calculations from the census of 1840, and other sources, the writer alluded to above, estimates the capital employed in the production of cotton as follows:—

1,200,000 slaves, at $500 each, is - -	$600,000,000
4,500,000 acres of land, at $10 per acre, - -	45,000,000
14,000,000 acres of land, in timber, pasture, &c., at $3 per acre, - - - - -	42,000,000
6,300,000 acres of land, in grain, at $10, - -	63,000,000
400,000 mules and horses, at $100 each, -	40,000,000
4,500,000 hogs and sheep, at $1 each, - -	4,500,000
300,000 cattle, at $5 each, - - -	1,500,000
500,000 plows, at $2 each, - - - -	1,000,000
Waggons, and other plantation implements, &c.,	1,000,000
	$798,000,000

There does not, however, appear to be any data that can be relied on to make an accurate calculation on this subject.

session, for the inspection of all disposed to see them; and he was requested by the General Court to exhibit them, and to give all explanations and information in his power respecting them. It is believed that these machines were the first made in the United States. Several machines from these models were made for different persons, and used in private houses.

The first Cotton Factory established in the United States, was at Beverly, in Mass., about 17 miles from Boston. It was organized in 1787, with (as is stated) a large capital. It continued in operation about fifteen years, making corduroys, bed tickings, and cotton velvets. The warps used were probably of linen. Yet the business was not profitable—the loss having been as great as ninety cents on the dollar—Gen. Washington visited this establishment on his tour thro' the country in 1789. Great interest was excited throughout all the northern and eastern States on the subject of manufactures. No models of machinery used in England could be procured, as the English Government, *with a jealous care for their own interests*, had prohibited, under heavy penalties, the exportation of any machines, or models or drawings of them. Many attempts were made to procure models, without success. TENCH COXE, one of the earliest, ablest, and most devoted friends of American manufactures, engaged a person to send him from London, complete brass models of Arkwright's patents. The machinery was completed and packed, but was detected by the custom-house officers and forfeited.

All attempts to introduce the Arkwright machinery had proved unsuccessful. But the cupidity of the British Government, aided by the utmost vigilance of

its officers, could not prevent its introduction. Mr. Samuel Slater, who had served a regular apprenticeship to the Cotton-spinning business, under Sir Richard Arkwright's partner, Mr. Strutt, arrived in New York in the month of Nov., 1789. In a letter, written by himself the 2d of Dec. following, to Moses Brown, of Providence, R. I., he says, "A few days ago, I was informed you wanted a manager of cotton spinning. If you are not provided for, I should be glad to serve you, though I am in the New York Manufactory. But we have but one card, two machines and two spinning jennies, which I think are not worth using. *My intention is to erect a perpetual carding and spinning*" (meaning Arkwright's patents). The answer to this letter was such, as to induce him to go to Providence; and in Jan. 1790, he made an arrangement with Messrs. Almy & Brown of that city, to commence preparation for spinning cotton at Pawtucket. There he commenced making machinery, principally with his own hands; and on the twentieth of the next December, he started three cards, machines for drawing and roving, and seventy-two spindles. *These were the first Arkwright machines put in operation in this country; and the credit* of introducing them belongs to Samuel Slater. He had no models or drawings to aid him in the construction of the machines, having been deterred from bringing them, for fear of detection by the British Government.

Some of Mr. Slater's first yarn, and some of the first cloth made in America *entirely of cotton*, was sent to the Secretary of the Treasury, the 15th of October, 1791.

Although they had some difficulty at first in disposing of their yarn, their business slowly increased; and, somewhere about 1795, Mr. Slater, in company with Mr. Oziel Wilkinson, built a small mill on the Massachusetts side of the river, at Pawtucket, *which was the first cotton factory in Massachusetts, with machinery on the Arkwright principle.* Their business continuing prosperous, and Mr. Slater's brother having arrived from England and brought a knowledge of the recent improvements of the English spinners, Almy and Brown and the Messrs. Slaters turned their attention to a more extended investment in cotton spinning; and in 1806, the village of Slatersville, R. I., was projected: a large factory was erected, and they commenced spinning in the Spring of 1807.

I have not time, on this occasion, to follow the personal history of Mr. Slater. I find the following obituary notice, copied from one of the periodicals of the time:—

"April 20th, 1835, died, at Webster, Mass., aged 67, SAMUEL SLATER, long known as an enterprising and respected citizen of Rhode Island, AND THE FATHER OF THE COTTON MANUFACTURES OF THIS COUNTRY, in which he acquired a great estate. The first cotton manufactory in the United States was built by Mr. Slater at Pawtucket R. I., which was standing and in operation at the time of his death." *

* An attempt to manufacture cotton was made at Derby, in Connecticut, under the patronage of Col. Humphreys, late Minister to Spain.

One at or near Hurlgate, N. Y., under the patronage of Mr. Livingston, was commenced, but failed and was abandoned. I believe nearly all the cotton factories in this country from 1791 to 1805, were built under the direction

Small factories spread in Rhode Island about the year 1807, and improvements began to be introduced by American artisans. As early as 1808, $80,000, was invested in the Globe factory, Philadelphia. The Arkwright machinery was introduced very early at Copp's Creek and at Kirk's Mill in Delaware.

But other sections of the country were also turning their attention to this important business.

ALEXANDER HAMILTON early saw the importance of manufactures to the country, and in his able report on the subject, made during Washington's administration, gave a sound tone to the public mind. *His memory should ever be held sacred by American manufacturers, as one of their earliest, ablest and best friends.*

In the early part of the year 1791, *on his recommendation, and by his active and influential exertions*, a number of spirited individuals of New York, New Jersey and Pennsylvania, associated themselves for the purpose of "establishing useful manufactures," by the subscription of a capital of more than $200,000. The general object of the association was to lay the founda-

of men who had learned the art or skill of building machinery, in Mr. Slater's employ.

Mr. Slater used to spin both warp and filling on the water frame, up to 1803.

Mules for spinning filling had not then been introduced. The cotton used to be put out to poor families in the country, and whipped on cords, stretched on a small frame about three feet square, and the motes and specks were picked out by hand, at from four to six cents per pound, as it might be for cleanness.

Mr. Slater used to work cotton from Cayenne, Surinam and Hispaniola, and made first quality of yarn. Sometime after, when short cotton began to be used, he mixed about one-third: he called the yarn of such, second quality, making 15 cts. per lb. difference. Thus, while number 12 was 84 cts. of 2d quality, number 12 of first quality was 99 cts. per pound.—*Memoir of Slater, pp.* 106–7.

tion of a great emporium of manufactures, *but their more immediate object was the manufacture of cotton cloths.*

Having resolved to establish themselves in New Jersey, the contributors were incorporated by the Legislature of the State on the 2d of November 1791, by an act authorizing a capital stock of one million of dollars, with the right to acquire and hold property to the amount of four millions, and the power to improve the navigation of the rivers, make canals for the trade of the principal site of their works, and to raise by way of lottery, one hundred thousand dollars. The act of incorporation, *which was drawn or revised by Mr. Hamilton*, also gave a city charter, with jurisdiction over a tract of six square miles.

After its organization, the society advertised their desire to purchase a suitable site for their city, with requisite water power, in any part of New Jersey. They received proposals from the "West Jersey Associates," from "South River," "Perth Amboy," "Millstone," "Bulls Falls," the Little Falls of the Passaic, and from the inhabitants of the Great Falls of that river; and in May, 1792, they selected the latter place, as the principal site of their proposed operations;—giving to their town the name of PATERSON, in honor of Gov. William Paterson, who had signed their charter. At a meeting of the Directors, on the 4th of July, 1792, appropriations were made for building factories, machine shops, and shops for calico printing and weaving. A race way was directed to be made, for bringing water from above the falls to the proposed mills. Unfortunately, the direction of these works was given

to a French engineer, whose magnificent projects and reckless expenditures uselessly spent a large sum of money for the company.

In January 1793, PETER COLT, Esq., of Hartford, then Comptroller of the State of Connecticut, was appointed general superintendent of the company. The French engineer resigned; and Mr. Colt, thus in sole charge of the works, abandoned the magnificent projects of his predecessor, completed the raceway, conducting the water to the first factory erected by the society. This factory was finished in 1794, when cotton yarn was spun in the mill. Yarn had been spun at this place the preceding year, by machinery moved by oxen. In 1794, calico shawls and other cotton goods were printed; but, owing to a combination of causes, the company resolved, in 1796, to abandon the manufacture, and discharged their workmen. No part of the failure of the enterprise was attributed to Mr. Colt; as the directors on closing their concerns, unanimously "returned him their thanks for his industry, care and prudence, in the management of their affairs, being fully sensible that the failure of the objects of the society was from causes not in his power, or that of any other man, to prevent."

The cotton mill of the company was leased to individuals, until 1807, when it was accidently burned down. In 1801 a mill seat was leased to Mr. Charles Kinsey, in 1807 a second, and in 1811 a third to other persons; and between 1812 and 1814 several others were sold or leased. In 1814, Mr. ROSWELL L. COLT, the present governor of the society, purchased at a depreciated price, a large proportion of the shares, and reanimated

+ "L' Enfant"

the association. From this period, the growth of Paterson has been steady, except in seasons of general or manufacturing depression.

Although out of the regular chronological order, I will mention here, that Mr. JOHN COLT, a son of Peter Colt, Esq., and a gentleman who by his education, sterling integrity, high sense of honor, and polished manners, is an honor to American manufacturers, commenced making *cotton duck*, in Paterson, the 7th of February, 1822. Cotton duck had been made in this country before, at Baltimore, and also some in New England; but the yarn was not doubled and twisted, and had to be heavily starched to prevent chafing in the reed, which rendered it nearly useless for sails, from its liability to mildew; but Mr. John Colt made the first cotton duck of doubled and twisted yarn, without starch or any kind of dressing, and also the first that was woven on power looms. The first year, he made about seventy pieces in this improved manner. In 1823, he made 201 pieces. The weaving was done by hand looms. On the 4th of March 1824, the first piece of cotton duck ever woven upon a power loom was produced. The article was found to be of excellent quality, and soon began to be extensively used for sails. Mr. Colt went on steadily increasing the manufacture. From 1826 to 1828, he averaged from five to six thousand pieces per annum. In 1831, he increased to about 9,000 pieces, and has carried the manufacture as high as 12,000 pieces per annum. There are also quantities of cotton duck made in New England, Maryland, &c.; but the article produced by Mr. Colt, has

always maintained its superiority, and commanded the highest price in the market.

The English have declined to use cotton duck for sails; and one shipbuilder refused to accept a suit of sails gratis, as he was satisfied it would not answer the purpose. *Perhaps they have obtained some light on this subject, as the sails of the* YACHT AMERICA *with which they became acquainted in* 1851, *were made of the ordinary duck from Mr. Colt's Mill.*

But, to return to the regular chronological order of events, I find that in 1807 there were in Rhode Island, Massachusetts and Connecticut, fifteen mills, with 8,000 spindles, producing about 300,000 pounds of yarn annually. By a report made to the government in 1810, it appears that eighty-seven additional mills had been erected by the end of 1809, of which sixty-two were then in operation by horse and water power, running 31,000 spindles. Upon the breaking out of the war of 1812, there were in Rhode Island thirty-three cotton factories with 30,663 spindles, and in Massachusetts there were twenty mills with 17,371 spindles. The yarn spun in these factories was woven by individuals upon hand looms. At this time the country received nearly all its cotton cloth from Great Britain and the East Indies. In 1807 and 1808, there were imported from Calcutta *fifty-three millions* of yards, principally of coarse cotton goods, and worth, as prices then were, over *twelve millions of dollars.* In 1810, there were made *in all the factories* in the United States, as appears by the return of the Hon. Albert Gallatin, then Secretary of the Treasury, *only eight hundred and fifty-six thousand six hundred and forty-five yards of cotton*

cloth, viz., in Rhode Island, 735,319; Massachusetts, 36,000; Vermont, 2,500; New Jersey, 17,500; Pennsylvania, 65,326. The whole number of yards made in the United States in that year, was sixteen million five hundred and eighty-one thousand two hundred and ninety-nine; of this 15,724,654 yards were of family manufacture. So imperfect was the machinery then in use, that the weaving alone cost *more than double* the whole process, after the introduction of the power loom.

We now arrive at an interesting period in the history of cotton manufactures in our own country. The *large enterprises* that had been attempted were premature. The Beverly Company had lost its capital. The "Society of Useful Manufactures" at Paterson, had suspended operations. I find but few who kept steadily increasing, but the increase was very slow. Those of Rhode Island, under the able lead of Mr. Slater and his associates, continued to make progress. The wars which grew out of the French Revolution, had thrown the carrying trade in a great measure into the hands of our merchants. It was very profitable, and the enterprise and capital of the country was mainly directed in that channel.

But with the war of 1812, came a different state of affairs. Our commerce for the time was nearly destroyed, and our foreign trade paralyzed. A positive necessity existed for domestic manufactures, and the men were not wanting who were equal to the emergency. To Francis Cabot Lowell and Patrick Tracy Jackson, both of Boston, Mass., and the able men that were associated with them, we are indebted for the

establishment of the cotton manufacture on a scale so ample, that we are enabled to supply a large portion of our own consumption, and to compete successfully in distant foreign markets with the wealthiest nations of the earth.

Shortly after the commencement of the war, Mr. Lowell, who had recently returned from England, impressed with the necessity, and convinced of its practicability, proposed to Mr. Jackson, to make the experiment on an ample scale. Great were the difficulties that beset the new undertaking. The state of war prevented any communication with England; not even books and designs, much less models, could be procured. The structure of the machinery, the very tools of the machine shop, the arrangement of the mill, all these were to be, as it were, re-invented. But men had got hold of the business now who, relying upon their own great talents, aided by the improvements in machinery which had been introduced by Mr. Slater and others, were capable of surmounting every obstacle. The first object to be accomplished, was to procure a power loom. To obtain one from England was impossible; and although there were many patents for such machines in our patent office, not one had yet exhibited sufficient merit to be adopted into general use. Under these circumstances, but one resource remained, to contrive one themselves; and this they immediately set about. After numerous experiments and failures, they at last succeeded, in the Autumn of 1812, in producing a model, which they thought so well of, as to be willing to make preparations for putting up a mill for weaving cotton cloth.

It was now necessary to procure the assistance of a practical mechanic to aid in the construction of the machinery, and they had the good fortune to secure the services of Mr. PAUL MOODY. The project had been hitherto exclusively for a weaving mill, to do by power what had before been done by hand looms. But it was ascertained that it would be more economical to spin the yarn than to buy it. A water power had been procured at Waltham, Mass., and associating with themselves some of the wealthy gentlemen of Boston, they put up a mill of about 1,700 spindles, with the necessary preparation, and power looms of their own contrivance, sufficient to weave their yarn. The mill was completed late in 1813. *This was the first manufacturing establishment in the world, that combined all the operations necessary for converting the raw cotton into finished cloth.*

The mills previously erected in this country, were for spinning only; and in England, although power looms had been introduced, they were used in separate establishments, by persons who purchased their yarn from the spinners.

Under the able management of the projectors, the business proved eminently successful, and was extended to the full capacity of the water power at Waltham. Although the first suggestions, and many of the early plans, for the new business had been furnished by Mr. Lowell, Mr. Jackson devoted the most labor and time in conducting it.

Great interest had also been excited in other sections of the country, on the subject of manufacturing, during the war. Several mills had been erected in

the State of New York, and elsewhere, and a large amount of capital (considering the wealth of the country at the time), invested. Upon the close of the war with Great Britain, and the opening of the foreign trade, this interest received a severe shock, and was much embarrassed by excessive importations of foreign goods.

Mr. Lowell, whose profound knowledge of the business and eminent abilities, peculiarly fitted him to impart correct information to others, repaired to Washington, in the winter of 1816; and in confidential intercourse with some of the leading members of Congress, he fixed their attention on the importance, the prospects, and the dangers of the cotton manufacture. The Middle States, under the lead of Pennsylvania, were strong in the manufacturing interest. The West was about equally divided. The New England States, attached, from the settlement of the country, to commercial and navigating pursuits, were less disposed to embark in the new policy, which was thought adverse to some branches of foreign trade, and particularly to the trade with India, from which the supply of coarse cottons was principally derived. The southern States, and particularly South Carolina, then represented by several gentlemen of distinguished ability, held the balance between the rival interests. After a protracted discussion marked by eminent ability on both sides, the South, under the able lead of the late distinguished and lamented John C. Calhoun, gave their influence to the new measure, and the tariff of 1816 was established. This was the first legislative enactment

recognizing the existence of the cotton manufacture in this country.

But the earthly efforts of Mr. Lowell were drawing to a close. He died in 1817, at the early age of forty-three. "Few men have accomplished as much to make their names known to advantage and remembered with gratitude," as FRANCIS CABOT LOWELL.

After the passage of the law of 1816, the business continued to increase. Mr. Jackson continued to manage the Waltham Company, and began, as early as 1820, to look around for some new locality where the business might be extended. In 1821, Mr. EZRA WORTHEN suggested to Mr. Jackson that the Pawtucket Canal, at Chelmsford, would afford a fine location for large manufacturing establishments, and that probably a privilege might be purchased of its proprietors. To the comprehensive mind of Mr. Jackson the hint suggested a much more stupendous project,—nothing less than to possess himself of the whole power of the Merrimack river at that place, known as the "Pawtucket Falls." Relying on his own talent and resolution, he set about this task at his own risk; and it was not until he had accomplished all that was material to his purpose, by purchasing the whole stock in the canal, and all the farms on both sides of the river, which controlled the water power, that he offered a share in the project to the proprietors of the Waltham Company and other persons whom it was thought desirable to interest in the scheme. This offer was eagerly accepted. Extensive additions were subsequently made, and in honor of his late lamented friend, the new town was named LOWELL. On the 6th of February, 1822,

the purchasers of the above-named property were incorporated as the "Merrimack Manufacturing Company," and vigorous measures were immediately adopted to carry out their plans. The personal superintendence of the business was confided to the late Kirk Boot, Esq. The foundation of the first mill was laid in 1822, and the first cloth produced in November, 1823. Mr. Ezra Worthen was appointed superintendent of the manufacturing department. He barely lived long enough to see the first commencement of the business. He died June 18th, 1824. In 1825, a reorganization of the company took place. It was found that there were mill privileges enough for several independent companies. It was deemed expedient that one company should have charge of the disposal of the land and water-power, and of the furnishing of machinery, without entering into the manufacture of cotton. The necessary acts were passed by the Legislature, giving the privileges above described to the Locks and Canal Company. The price of the shares in this company under the reorganization, was $500 each; the annual dividends were large, and when at last it was thought expedient (about 1845) to close the affairs of the corporation, the stockholders received of capital nearly $1,600 per share.

I cannot at this time, enter into a detailed history of the growth of this place; after the establishment of the Merrimack Company, others soon followed. Its advancement in wealth and all the elements of civilization, has been singularly rapid. In 1826, the population was 2,500, in 1840—20,796; and in 1850 it was 33,385. In 1850, there were nine companies, owning

thirty-four factories, engaged in manufacturing cotton goods, employing a capital of eleven million five hundred thousand dollars; with 305,004 spindles, 19,569 looms, besides bleaching, dyeing and printing works, employing 7,524 female and 2,427 male operatives. But I will not go further into the statistics of Lowell—merely adding, that there are manufacturing interests in that city of large amounts, other than cotton. There is however, one other interesting fact. There are two banks for savings in Lowell, one the "Lowell," and the other the "city." The Lowell Bank had on deposit, the first Saturday in November, 1850, from 4,609 depositors, \$736,628 $\frac{12}{100}$. The City Bank at the same time had on deposit from 615 depositors \$75,970 $\frac{51}{100}$. The operatives in the mills are the principal depositors in these banks.

Great attention is paid to the physical, intellectual and moral welfare of the inhabitants and operatives in the mills. A large hospital under able management, has been established. There is a valuable library of 7,000 volumes belonging to the city, to which any one can have access by paying fifty cents per annum; and the Lowell Institute, which has for its object the management of a course of lectures delivered every Winter. Excellent schools are also maintained. In 1840, a paper called the "Lowell Offering" appeared, made up entirely of original matter written by the operatives. This periodical has obtained an extensive reputation. In 1844, selections from it were published in England under the significant title of "Mind among the Spindles." In 1845, there were twenty-three regularly constituted religious societies. They have erected twenty-

one churches, at a cost of more than three hundred thousand dollars. Connected with these societies, there were over six thousand Sunday school pupils and teachers; all this was accomplished in the short period of twenty-seven years. An unsettled territory has been covered with substantial edifices, mills, stores, churches, blocks of houses, the prosperous homes of nearly 35,000 people. A result highly creditable to the men who took the lead in this enterprise, has been the reward of this liberal display of their wisdom and humanity. Aided and encouraged by these advantages, the morals of the operatives in the factories have been cherished and preserved, and their intellectual and physical energies strengthened and improved. The superior intelligence and efficiency of the operatives at Lowell over those employed in the factories of the old world, is as manifest as it is gratifying.

The intimate connection between a high standard of morality and intellectual and physical efficiency, deserves profound consideration. It may be the turning point in our favor, in our manufacturing rivalry with other nations. It gives me great pleasure to be able to say that Lowell is not alone entitled to this high commendation. The founders of the factories in Rhode Island and Paterson early saw and justly appreciated the value of a high standard of morality among their operatives, and have been unwearied in their efforts to cherish and sustain it. These leading examples have imparted a healthy tone of moral feeling in relation to these establishments as they have been, and still are, extending throughout our country.

It would be gratifying to follow the personal his-

tory of Mr. Jackson. It is well worth studying as an example of boldness of conception, great foresight, a perseverance that nothing could check, triumphing over all obstacles, and rising superior to difficulties, blended with the strictest honor and integrity, that always sustained him.

It was through his exertions, that the Boston and Lowell Railroad was undertaken and completed. It was opened for travel in 1835, and soon justified the wisdom of his anticipations. Afterwards, on the death of Mr. Boot, he had the immediate charge of the Locks and Canal Company. During the last few years of his life, he was treasurer and agent of the Great Falls Manufacturing Company, at Somersworth, which owes its success mainly to his able management. His labors and responsibilities were severe, and a gradual prostration of his physical system admonished him that the time was drawing near when his connection with earthly pursuits must cease. He died at his residence in Beverly, the 12th of September, 1847, in the 68th year of his age. The news of his death was received as a public calamity.

During the period above mentioned, whilst manufactures were being firmly established in New England, they were rapidly spreading in other sections of the Union. My limits will only allow me to refer to the earliest establishments in our own State. The first Cotton Factory in New York was built by Doct. Capron, in Oneida Co., about the year 1809. Then followed the Mills of Hudson, Columbia Co., built by Mr. Jenkins; then those of Pleasant Valley, Dutchess Co. and the Matteawan Mills in 1814: about the same

time, several mills were erected in Orange county, one at Ramapo, Rockland county, by the Messrs. Pierson; also one at Schaghticoke. The county of Oneida has probably more capital employed in this branch of business than any other in this State. The NEW YORK MILLS in that county, under the management of the Messrs. Wolcotts, enjoy a justly distinguished reputation for the excellence of their goods. These gentlemen are entitled to distinguished credit for their successful efforts to improve and perfect the cotton manufacture. Many other factories have also been erected in other parts of the State. But the capital invested in this branch of industry is much less in New York than in some of the smallest New England States. The manufacture has also spread in Pennsylvania and Maryland, some of the western and many of the southern States; among the latter Georgia takes the lead.

Calico printing was commenced in this country the latter part of the 18th century. As early as 1790 Herman Vandausen, a German, settled in East Greenwich, R. I., and commenced block printing by hand. The cloths printed by him, were mostly of domestic manufacture. He, however, soon gave up the business as unprofitable. About this time also, many cloths were imported from India, and printed in Providence, in the same manner, by foreign workmen who had come to reside there.

Zachariah Allen, ancestor of the present distinguished manufacturers and calico printers of that name in R. I., and who was then largely engaged in the East India trade, was among the first who had India cloths printed in this country. Block printing was also com-

menced very early in Philadelphia, by an Englishman of the name of Thorpe. Somewhere between 1820 and 1824, Mr. John Thorpe, a nephew of the above-named gentleman, built an establishment for the firm of Crocker and Richmond, at Taunton, Mass. Their first printing was done by hand.

The first cylinder machine for printing calicoes, I believe, was put in operation at this place. The model of this machine, together with some engraved copper cylinders, was imported from England, in 1825, by Wm. J. Breed, now living in Providence, R. I. At the time he made this importation, all such exports were strictly prohibited by the English Government, and it was very difficult even for skillful workmen to get away. The law was however soon altered, when the business made rapid progress. Andrew Robeson Esq., of New Bedford, Mass., was one of the pioneers in this business, and still has, in possession of the family, the first calico-printing machine made in this country. The greatest improvements in this business have been brought from abroad. A machine invented by R. L. Hawes, of Worcester, Mass., has, however, just been completed for a distinguished printer in R. I., for printing 12 colors by one operation, *which has never before been attempted in the world.* I am not informed of the exact amount of calicoes printed in the United States at present; but it is very large, and has nearly superseded foreign importations. Some idea of its increase may be formed from the fact that about 1826, the Merrimack works at Lowell, Mass., which then produced less than one thousand pieces per week, now turn out about ten thousand and five hundred pieces each week. There

are some other large establishments in Massachusetts and several in Rhode Island, whose production is nearly or quite equal to this. In New York, New Jersey and Pennsylvania, there are also other calico printing establishments, where the art is carried to a very high degree of perfection.

I will take occasion in this place to notice briefly, a few of the men whose names will be honored when the history of the cotton manufactures of the United States shall be written.

Mr. Paul Moody, before mentioned, was born in Newbury, Mass., in 1777, and before the manufacturing enterprise of Messrs. Lowell and Jackson, was in partnership in the manufacturing business with Mr. Ezra Worthen. In 1814, he removed to Waltham, and rendered the most valuable services in starting the first mill at that place, he supplied an important movement in the power loom of Messrs. Lowell and Jackson, to which that machine owed its successful operation. He invented what is called the dead spindle, which was introduced at Waltham, and is now used in many mills in Lowell. The Rhode-Island machinery employ the "live spindle," copied from the English. He invented what is called the "filling frame," which is still in use in Waltham and Lowell. He invented a "governor" to regulate the speed of their wheels, and the first one he made was in successful operation until 1832. With the assistance of Mr. Lowell, he invented the "double speeder," a piece of machinery the celebrated "Dr. Bowditch" declared, "required for its construction the greatest mathematical power of any piece of mechanism with which he was acquainted." Besides the double

speeder, the Waltham company patented a "spinning frame" dressing frame, and "warper," all the invention of Mr. Moody. It is an evidence of the great value attached to the services of this gentleman, that when, in 1823, he went to Lowell, taking with him models and mechanics from Waltham, the Company at Lowell paid the Waltham Company as a remuneration, one hundred thousand dollars. He was at the head of the machine shop in Lowell, until the time of his death, July 7th, 1831.

To MR. KIRK BOOT, Lowell was as much indebted for its success as to any other individual. He was there when the first mill was erected, superintending the interest of the Merrimack Company; and was appointed to the agency of the Locks and Canals, upon the reorganization of that Company in 1825. As a man of prompt business habits, of great power to manage men, and to grasp and master extensive and complicated details, rarely has he been excelled. At the same time, by his high sense of honor, his lofty integrity, his quick perception and decided practice of what was right, he had always a hold upon the respect and affections of those he employed. He devoted his services to the Company until his death, which took place the 11th of April, 1837.

Mr. W. B. LEONARD, of New York, who was for a long time connected with the Matteawan Company, has rendered valuable services to the cause of manufactures, both by importing and improving machinery. The loom introduced at Waltham, heretofore noticed, in consequence of being confined to a certain slow speed, did not go into general use, and was succeeded

by what is known as the Scotch loom, introduced at Providence, R. I., from abroad by Mr. Gilmour. It remained as introduced till 1827, when important mechanical improvements were made by Mr. Leonard, by which the texture of the cloth was much improved. This loom, as improved, was first introduced into the New York Mills, and continues in use to the present day. The next improvement was a spreading and lapping machine, introduced from England, by Mr. Leonard, then, an improvement on the "railway drawing head," a very valuable one, patented by him in 1833.

The "self-acting mule," came into use in England and Scotland about the time the American manufacturers were turning their attention to making printing cloths. Under the laws of England, it could not be exported; and, as our laws then were, a foreigner could not take out a patent in this country. Many enterprising men went to England for the purpose of bringing out models of this machine; they, however, did not succeed. But Mr. W. A. Leonard went out, *and succeeded*, at great hazard to himself, in bringing it to this country. The model was made of the exact size to fill a traveling trunk, and smuggled into the cabin of the vessel whilst Mr. Leonard and the Captain (by previous agreement) were fighting, for the amusement of the custom-house officers. During the time they were obtaining the model, Mr. W. B. Leonard was at Washington procuring a special law to secure the right of the machine to the inventor. He had prevailed on the committee to make a favorable report; but the final passage of the bill was in much doubt, when an honor-

able member of the House, from Kentucky, determined that everything should be done that could possibly benefit his constituents, strongly advocated the passage of the bill, on the ground that his State and the whole West, were as much interested in the improvement of the breed of mules as the North; and he declared, as his "firm conviction, that Kentucky could raise more and better mules than other section of the country." The bill became a law, and the mules were readily bought by the eastern manufacturers; but I am not aware that the breed of mules in Kentucky has been materially improved by the operation!

One of the most ingenious machines ever invented, was produced by AMOS WHITTEMORE, Esq., of Cambridge, Mass., in 1797, for making cards, which, by a simple operation bends, cuts and sticks the card teeth with a cheapness, celerity and perfection before supposed impossible. This machine has been patented abroad, and is the only one ever invented that approximates at all to the desired result.

Among the many artists and mechanics to whom this important manufacture is indebted for its present highly improved condition, Mr. WILLIAM MASON, of Taunton, Mass., stands preëminent. This gentleman is a native of Mystic, Conn., where he was born in 1808. At the age of thirteen he commenced working in a cotton factory. At seventeen he went into a machine shop, where he at once displayed great mechanical genius and powers of invention. He soon perfected an improvement in the power loom for weaving diapers and cloths of that description. The frame known as the "Ring Spinner," invented by John Thorpe, and im-

proved upon by several others, was, nevertheless, inefficient until perfected by Mr. Mason. He saw the advantages of the principle upon which it was intended to operate, and by his inventive genius supplied the defects in its construction, and rendered it a very important and valuable machine, which has now gone into extensive use among manufacturers. But the great invention on which his fame principally rests, is his "SELF-ACTING MULE." The attention of the best mechanics in England and America had long been turned to this invention, and several different machines of this kind had been produced in England. As early as 1838 Mr. Mason gave his mind to it; and after laborious, patient and persevering application, he succeeded in bringing the machine to operate, and about 1839, took out his first patent. About 1843, he took out a second patent for improvements therein, and the machine began to be appreciated and adopted by manufacturers. He has continued to improve upon it, and it is now, probably, as perfect a spinning machine as there is in the world. I have seen more than 33,000 spindles, constructed upon Mr. Mason's principle, operating in one room at the same time, producing the most beautiful yarn, and with such admirable facility and precision as to suggest the idea "of reason and intelligence in the machines themselves." This gentleman, whose rare and unobtrusive modesty is exceeded only by his skill and untiring industry, has made and put in operation upon his principle in the United States, about 600,000 spindles. His superior artistic taste has contributed more to the beauty and just proportion of form of the various machines to which his attention

has been devoted, than that of any other artisan. In addition to cotton machinery, he is now engaged in the manufacture of *locomotive engines;* and should he display the same taste and skill in their construction which he has developed in the production of other machinery, the IRON HORSE of the United States will exceed in symmetrical elegance and beauty, that of any other country.

The "Danforth Frame," (or, "Cap Spinner,") was invented by Mr. CHARLES DANFORTH, a native of Bristol county, Massachusetts, and a descendant of one of the old pilgrim families of that commonwealth. He commenced work as a throstle piecer in a cotton factory, as early as 1811, at the age of 14 years, and continued to be employed in operating cotton machinery in its various departments in different establishments in his native State until 1821, when he removed to the State of New York, and was employed about four years by the Mattaewan Company, at Fishkill. In 1825 he removed to Ramapo, Rockland county, New York, where he was employed as superintendent of a small cotton mill, and was acting in that capacity in 1828, when he made this discovery. The superiority of this machine consists in its rapid production of yarn, and it is said that a lower quality of stock can be used to advantage, and at the same time a good quality of yarn produced. The usual speed of the bobbin is 8,000 revolutions per minute, and the product eight hanks per spindle per day of number 20, or in that proportion for other numbers. The ingenious inventor secured a patent in England in 1830, where he put in operation some 15,000 spindles on his plan, and realized a handsome

sum for his patent rights. The machine is mentioned with commendation by some of the ablest English writers on mechanics, under the name of the "American throstle." Mr. Danforth has put about 200,000 spindles in operation in this country, on his principle; and I am happy to say of him what cannot be said of all inventors, he has realized a handsome fortune by the fruits of his industry and ingenuity. He is still engaged in business at Paterson, New Jersey.

About the year 1823, Mr. GEORGE DANFORTH, of Taunton, Mass., brother of the inventor of the "Cap-Spinner," invented an important machine called the counter-twist speeder, but generally known as the "Taunton speeder." The double speeder, invented at Waltham by Messrs. Lowell and Moody, was the only one in use in this country, and was so expensive, as to bear with great severity upon manufacturers of small means The price of the Waltham speeder, with twenty spindles, was $2,400. The counter-twist speeder, invented by Mr. Danforth, was sold for $350, and could do more work than the Waltham machine. This invention, with various modifications, but essentially on Danforth's principle, has gone largely into use in this country and Great Britain. Mr. Dyer, a native of Rhode Island, took out to England Whittemore's card machine, and for many years monopolized the manufacture of card clothing in England. Mr. Danforth's counter-twist speeder was also placed in his hands, and from these two American inventions he has realized a princely fortune.

Great difficulty had been experienced from the

want of a proper machine to prepare the cotton for the cards. A lapping and spreading machine had been introduced from England, by Mr. Leonard; but this machine was not satisfactory. Some other improvements had also been made by others, but they were inefficient. About 1831, Mr. John C. Whitin, of Whitinsville, Mass., seeing the great necessity of a machine for this purpose, turned his attention to the invention of one. After spending about one year in patient investigation, he succeeded in inventing a machine known as "Whitin's Picker and Lapper," which has received the decided approval of manufacturers, and gone into extensive use. He took out letters patent for it, 20th July, 1832.

Before the invention of any machine of this kind, cotton had to be picked by hand, at an expense of about six cents per pound, and the work, even at this price, was imperfectly done. With Mr. Whitin's machine, it can be picked, lapped and prepared for the cards for about one mill per pound. It is unquestionably the best machine for the purpose intended, that has ever been produced. Mr. Whitin, in company with his brothers, under the firm of Paul Whitin & Sons, have a large machine shop and cotton factory at Whitinsville, Mass., and are justly known as business men of great enterprise, unblemished integrity, accomplished machinists, and superior manufacturers.

Among the individuals who by their personal exertions have contributed most largely to the increase of the cotton manufactures of the United States, is the Hon. Charles T. James, of Rhode Island. Although not claiming to be an inventor, he has displayed great

skill and tact in bringing out and combining the inventions of others, and has been the great advocate of the application of steam power as a motor for manufacturing purposes. Mr. James commenced learning to make machines in 1826. By the year 1830, he had become thoroughly and practically conversant with all kinds of cotton machinery then in this country, and had built more or less of all kinds of it with his own hands. In 1830–31, he started a cotton mill at Thompson, Conn., and in 1831–32 built the machinery for a mill to spin and weave No. 60, the finest work then ever attempted in the United States. In 1833, rebuilt the Kennedy Mills, so called, at Central Falls, near Pawtucket, R. I. In 1834, commenced overhauling the Providence steam mill for Samuel Slater, Esq. Up to this time, Mr. James was but little acquainted with steam power. He continued in this mill for some time, and made many valuable improvements in the manufacture of fine cottons, and also in the steam engine.

In 1837 and '38, built what is known as the Bartlett Mill No. 1, at Newburyport; in 1840 and '41, erected Bartlett Mill No. 2, at the same place.

In 1843 and '44, built the James Mill, at Newburyport, and the Penn Mill, at Pittsburg. In 1844, '45, '46, and '47, built the Globe Mill, at Newburyport, Conestogo Mill No. 1, at Lancaster, Penn., and the Naumkeag Mills, at Salem, Mass. The latter is one of the largest mills, as a whole, in the United States, and contains over 33,000 spindles. During the last-named period, three other mills were erected under the direction of Mr. James; one in Maine, one in Massachusetts, and

the other in Rhode Island. In 1847, '48, '49 and '50 he erected the Charleston cotton mill, Charleston, S. C.; two mills at Fitchville, Conn.; one at Rockport, Mass.; two more at Lancaster, Penn., for the Conestogo Co.; one at Harrisburg, Penn.; one at Reading, Penn.; one at Sag Harbor, L. I.; one at Cannelton, Ind.; and reconstructed two others at Gloucester, N. J.

In 1851, he erected the Atlantic muslin de laine Mill, at Olneyville, near Providence, R. I. This mill was commenced in January, 1851, and is now in full operation.

The whole number of mills planned and erected by Mr. James since he commenced operations, is something over 30, containing in the aggregate nearly 300,000 spindles, and between 7,000 and 8,000 looms. I am informed that the value of the aggregate product of all the mills built or reconstructed by him, is about $8,000,000 per annum. In 1851, Mr. James was elected a member of the "United States Senate" by his native State, and is at the present time a member of that august body.

About the year 1842, Mr. E. B. Bigelow, of Massachusetts, made an important invention for a power-loom for weaving ginghams, and other colored goods. In 1844, a project for weaving checks and ginghams was started; it found immediate favor in Boston, and the stock was readily subscribed. A location was fixed upon, on an unoccupied fall of the Nashua River, at Lancaster. The real-estate was purchased, the work was commenced, and prosecuted with all possible dispatch. The cost of the mill was $802,284\frac{16}{100}$, and is producing about 4,500,000 yards of ginghams per an-

num, of a quality and cost which has nearly driven all similar foreign goods out of the American market. Although the cost of the mill was thought to be high, it had paid a profit up to 1851 of $102,000. Mr. Bigelow has also invented several other valuable and important machines, among which is a power-loom for weaving coach lace, and one for weaving brussels and tapestry carpets. These inventions show high mechanical genius, and place him in the front rank of American inventors.

There are also many other meritorious men who by their inventions and improvements, and skill as superintendents and overseers of factories, deserve special commendation. There has been a series of continual inventions and improvements in machines since they were introduced into this country. A bare enumeration of them would occupy too much time on this occasion. The great capitalists and merchants of Boston and other cities and towns in New England, with clear-sighted and far-seeing sagacity, early discovered the great advantages that would accrue from the introduction of this branch of industry, and lent their powerful aid to its support.

In speaking of labor-saving machinery, there is one thing that is generally lost sight of, and that is, the great merit there has been displayed in inventing the tools which are used to make the machinery with. A visit to a machine shop, where the machines are made, is quite as interesting, as to the factory where they are used. In this department, the Americans stand pre-eminent.

In a report drawn up by the late P. T. Jackson,

whom I have previously mentioned, it is stated, that prior to the passage of the act of 1816, there were 11,000,000 lbs. of cotton consumed per annum. There are no data to be relied upon, for continuous quantities spun between 1816 and 1825–1826. Since that time, returns have been annually made. In 1826 and 1827 the quantity spun in the United States, was 103,483 bales, estimated at 330 lbs. each, net of tare, equal to 34,149,390 lbs. From 1828 to 1830, there were embarrassments among the manufacturers and their customers; consequently the consumption was less than might otherwise have been expected, being 43,646,640 lbs. or 126,512 bales of 345 lbs. each; in 1832 and 1833, the quantity reached 194,412 bales of 360 lbs. each; in 1835–'36, it was 236,733 bales; in 1837–'38, 246,063 bales; in 1839–'40, 295,193 bales. In 1841–'42, there was great manufacturing and mercantile distress, and consumption fell off to 267,850 bales. In 1842–'43, it rose to 325,129 bales. In 1844–'45, the amount was 389,006 bales. In the above statement, the quantity manufactured refers to such purchases as are made by our manufacturers from bales brought to exporting ports. But there is a further quantity taken from plantations in the interior to mills in the Western and Southern States, which must be added to the 389,006 bales. It is estimated at 41,000 bales, making 430,006 bales of 410 lbs. each, equal to 176,302,460 lbs. In 1845,–'46, 176,800,000 lbs. This is an increase from 11,000,000 lbs. in 1816 to 1845–'46, of more than sixteenfold in 29 years. In 1847–'48, we took 531,772 bales from the shipping ports, and by an estimate 75,000 from the plantations to the southern and western mills, making

606,770 bales of 420 lbs. net of tare, equal to 254,843,400 lbs. Here is an augmentation of about 45 per cent. in manufactures, in three years. The result of this rapid increase was an over production of goods, consequent low prices, and serious loss to the manufacturers.

Since 1847–'48, the consumption of cotton has been less than in some previous years, owing to the failure of some concerns and the short working of others. In 1849–'50, it was 595,269 bales. In 1850–'51, in consequence of the very general depression in the business, and the high price which cotton obtained, the quantity consumed did not probably much exceed 495,000 bales.

Prior to 1826, there was no separate record kept of the value of cotton goods exported, but it must have been quite small up to that time. Since then the records kept by the treasury department show the declared value of cotton manufactures exported from the United States, to be as follows:

1826,	$1,138,125		1839,	2,975,033
1827,	1,159,414		1840,	3,549,607
1828,	1,010,232		1841,	3,122,546
1829,	1,259,457		1842,	2,970,690
1830,	1,318,183	Nine months to 30th June.	1843,	3,223,550
1831,	1,126,313	Year ending 30th June.	1844,	2,898,780
1832,	1,229,574		1845,	4,327,928
1833,	2,532,517		1846,	3,545,481
1834,	2,085,994		1847,	4,082,523
1835,	2,858,681		1848,	5,718,205
1836,	2,255,734		1849,	4,933,129
1837,	2,831,473		1850,	4,734,424
1838,	3,758,755		1851,	7,241,205

By this table we learn that the whole declared value of the exports of the manufactures of cotton from the United States, from 1826 to 1851, inclusive, amounts to SEVENTY-SEVEN MILLION, EIGHT HUNDRED AND EIGHTY-SEVEN THOUSAND FIVE HUNDRED AND FIFTY-THREE DOLLARS, ($77,887,553.)

By the census returns of 1850, the amount of capital invested in the different States, with various other interesting statistics (some of which, however, I do not think are correct) in relation to the cotton manufacture, were as follows:

Amount of Capital invested in the COTTON MANUFACTURE *in the United States, and value of the Entire Product, &c., &c., as per the Census of* 1850.

State.	Capital invested.	Bales cotton.	Tons coal.	Value of all raw material.	No. hands employed.		Entire wages per month.		Average wages per month.		Value of entire product.	Yards sheeting, &c., &c.	Sundries.
					Male.	Female.	Males.	Females.	Males.	Females			
Maine,	$3,329,700	31,531	2.921	$1,573.110	780	2.959	$22.895	$35,973	$29 35	$12 15	$2 596,356	32,852,556	
N. Hampshire,	10,950,500	83.026	7,679	4,839 429	2,911	9,211	75,713	124,131	25 45	13 47	8.830,619	113,106,247	149.700 lbs. yarn.
Vermont,	202.500	2 243		114,415	94	147	1,460	1,861	15 55	12 67	196,100	1.651.0 0	53.050 " "
Massachusetts,	28 455 630	223 607	46.545	11,289,309	9.293	19.437	212,892	264 514	23 01	13 55	19.712,461	298 751,392	353,660 " "
Rhode Island,	6.675 000	50,713	13.116	3 484.579	4.959	5 916	92,282	76,656	18 61	12 95	6,447,120	96 725,612	1.902.980 " thr'd & y'n.
Connecticut,	4.219,100	39 481	2,866	2,500,062	2.708	3.478	51,679	41.060	19 08	11 81	4,257,522	51.780,700	950,000 " yarn.
New York,	4,176,920	37.778	1.539	1.985 973	2,632	3,688	48 244	35,699	18 33	9 68	3,591,989	44,901 475	2,180,600 " "
New Jersey,	1,483 500	14,437	4,467	666.645	616	1,096	11,078	10.487	17 98	9 56	1,109 524	8.122 580	2,000,000 " "
Pennsylvania,	4,528,925	44,162	24,189	3,152 530	3,564	4,099	63,642	40,656	17 86	9 91	5,322 262	45.746 790	5.308 561 " "
Delaware,	460.100	4 730	1,920	312.068	413	425	6.326	4,926	15 55	11 59	538,439	3.521.636	533.000 " "
Maryland,	2,236.000	23.325	2,212	1,165.579	1,008	2,014	15.546	19,108	15 42	9 53	2,120,504	27.883 923	46.000 " "
Virginia,	1,908,900	17,785	4,805	828.375	1,275	1,688	12.983	11,791	10 15	6 98	1,486.384	15,640.107	1.755,915 " "
North Carolina,	1,058,800	13,617		531.903	442	1,177	5.153	7,216	11 66	6 13	831.342	2,470,110	2,267,000 " "
South Carolina,	857.200	9.929		295,971	399	620	5 565	5,151	13 94	8 30	748,338	6,563,737	1.348 343 " "
Georgia,	1,736,156	20,230	1,000	900 4.9	673	1,399	12,725	10,352	14 57	7 39	2,135.044	7,209,292	4,198,351 " "
Florida,	80,000	600		30,000	28	67	900	335	32 14	5 00	49.920	624 000	
Alabama,	651,900	5,208		237,081	346	369	4,053	2,946	11 71	7 98	382,260	3,081,000	790,000 " "
Mississippi,	38,000	430		21,500	19	17	270	101	14 21	5 34	30,500		171,000 " "
Louisiana,													
Texas,													
Arkansas,	16.500	170		8,975	13	18	190	106	14 61	5 88	16.637		81.250 " "
Tennessee,	669,600	6,411	3,010	297.500	310	581	3,394	3,730	10 95	6 42	510.624	363.250	2,326 250 " "
Kentucky,	239 000	3.760	720	180.907	181	221	2,707	2,070	14 62	9 36	273,439	1,003,000	725 000 " "
Ohio,	297,000	4,270	2,152	237,060	133	269	2,191	2,534	16 60	9 05	394.700	280,000	433,000 " "
Michigan,													
Indiana,	43,000	675	300	28,220	38	57	495	386	13 00	6 77	44,200		300,000 " "
Illinois,													
Missouri,	102,000	2,160	1,658	86,446	75	80	820	800	10 94	10 00	142,900		13,260 bales batting.
Iowa,													
Wisconsin,													
California,													
Dist. Columbia,	85,000	960		67,000	41	103	575	825	14 02	8 01	100,000	1,400,000	
Total,	$74.501,031	641,240	121,099	$34,835,056	33,150	59,136	$653,778	$703.414			$61,869,184	763,678,407	27.873,600 lbs. and bales.

This is the result of the progress of our country in this department of industry in little more than fifty years, mainly brought about by the introduction of labor-saving machinery.

"Our clock strikes when there is a change from hour to hour; but no hammer in the Horologe of Time peals through the universe when there is a change from era to era."* May we not, however, clearly discern in the progress of invention in the last half century, and its devotion to works of usefulness and the arts of peace, the commencement of not only a new, but of a more truly glorious and happy era in the history of mankind?

During the earlier part of the period we have been considering, the fields of Europe were red with the blood of contending armies. If there was a pause in the whirlwind of battle, it was but the pause of exhaustion to gain new strength for renewed contention. This has passed away.

A spectacle new in this world's history has taken its place, the nations of the earth gather together in a gorgeous edifice, new in its architectural designs, appropriately named THE CRYSTAL PALACE, to test the superiority of artistic skill.

The monarch of earth's proudest nation takes the lead in this high festival, giving an earnest that in all coming time, labor and artistic excellence shall bear the palm and receive distinguished honors.

* Carlyle.

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APPENDIX.

CHRONOLOGICAL SUMMARY

OF THE GROWTH AND TRADE IN COTTON, AND OF IMPORTANT INVENTIONS AND IMPROVEMENTS IN ITS MANUFACTURE.

By A. G. Dudley

B. C.

440, or about that time, first mention of cotton in history by Herodotus.

63. Cotton awnings first used in the theater at Rome, by Lentullus Spinther.

A. D.

50. Cotton plant extensively known in Egypt and some of the adjacent countries.

800. Cotton used in Greece in the manufacture of paper.

1252. Cotton goods made in Persia.

1280. Manufacture of cotton introduced into China from India.

1298. Cotton used in England for candle-wick.

1368. Cotton used extensively in China.

1430. Fustians first made in Flanders, with a linen warp and cotton weft.

1500. First attempt to introduce cotton goods into England.

1516. The Caffres, in Southern Africa, wore cotton dresses.

1530. The common spinning wheel invented by Jurgen, at Brunswick, in Germany.

1560. Cotton imported into England from the Levant.

1565. First act of British parliament relating to cotton goods.

1582. A mercantile commission sent from England to Constantinople and other parts of Turkey, to learn any secrets in the arts of manufacturing, dyeing, &c.

1589. The stocking frame invented by William Lee.

1590. Cotton cloth brought to London, from Benin, on the coast of Guinea.

1631. Printed calicoes first introduced into London, from India.

1641. Cotton wool imported into England exclusively from the Levant. At this period, all warps were made with linen, and wove with cotton imported from Cyprus and Smyrna.

1644–50. Conquest of China by the Tartars; manufacture of cotton greatly increased in that empire.

1650. Very fine calicoes and muslins made at Calicut, in India, which were whitened with lemon-water.

" Fustians and dimities first introduced into England.

1670. The Dutch loom first used in England.

1676. Calico printing commenced in London. Introduced into England the year before.

1677. Value of India calicoes consumed in England £160,000.

1688. 450,000 lbs. raw cotton, and 1,450,000 lbs. of yarn imported into France from the Levant.

1698. First steam engine constructed and turned to useful purposes, by Savery.

1700. Manufacture of muslins first attempted at Paisley, Scotland.

1701. Value of cotton goods exported from England, £23,000.

1725. Lawns and cambrics first manufactured at Glasgow—James Monteith being the first manufacturer who warped a muslin web in Scotland.

1733. First cotton yarn spun by machinery in England, by Mr. Wyatt.

1734. The Trustees of Georgia were presented with a paper of cotton seed, by Philip Miller, of Chelsea, England.

1735. The Dutch first export cotton from Surinam.

1738. Lewis Paul first took out a patent for a machine for spinning with rollers, invented by John Wyatt.

" The fly shuttle invented by John Kay, of Bury, England.

1742. The first Mill for spinning cotton in England erected at Birmingham. It was moved by asses, was unsuccessful, and the machinery was sold in 1743.

1750. The fly shuttle in general use.

" 3,831,620 lbs. of raw cotton, and 3,381,625 lbs. yarn, imported into France from the Levant.

1753. A cotton reel invented by Mr. Earnshaw.

1756. Cotton velvets and quiltings first made in England.

1760. Warping mill invented. Drop shuttle box invented by Robert Kay. Value of cotton manufactures in Great Britain at this period, £200,000 per annum.

1760. James Hargreaves applied the stock-card to the carding of cotton, with some improvements.

1762. Cylinder cards invented.

1763. Bleaching by the old methods generally introduced in England.

1765. The manufacture of calicoes first attempted in England. Cotton velvets first made at Amiens, in France.

1766. Value of cotton goods made in England, £600,000 per annum.

1767. The spinning jenny invented by James Hargreaves.

1768. The stocking frame applied to the making of lace by Hammond.

1769. Mr. Arkwright, afterwards Sir Richard Arkwright, obtained his first patent for spinning cotton with rollers, and built his first mill at Nottingham. This was driven by horse-power, which proving too expensive, he and his partners built another mill at Cromford in Derbyshire, which was turned by water—hence his spinning machine was called the *water-frame*.

1772. First cotton goods made in England with cotton warps.

" Messrs. Arkwright & Co. successfully attempted the manufacture of calicoes.

1774. Chlorine, or oxymuriatic acid, discovered by Scheele, a Swedish chemist.

1775. The first Provincial Congress of South Carolina recommend to the inhabitants to raise cotton.

1777. Green dye for calicoes introduced by Dr. R. Williams.

1779. Cayenne, Surinam, Essequibo, Demerara, and St. Domingo cotton most in esteem in England.

" The mule for spinning cotton invented by Samuel Crompton.

1780. First cotton mill built in Ireland. In 1824 Ireland had 145,000 spindles.

1781. Brazil cotton first imported from Maranham into England.

1782. A panic created in the cotton market of Manchester, England, in consequence of 7,012 bales of cotton being imported between December and April.

" James Watt obtained his patent for the steam engine. It had come into extensive use, to move machinery, in 1790.

" Some American manufactures of cottons first advertised for sale in Philadelphia.

1783. Surat and Bourbon cotton first imported into England about this time.

" Arkwright's machinery for carding and spinning cotton by steam, first used in Manchester, England.

1784. Arkwright's first patent expired, and a great impulse given to the manufacture of cotton.

" The cotton manufactured in Great Britain this year was 11,280,238 lbs., and valued at £3,950,000.

" Cotton imported into England, in small quantities, from the United States.

" First machine for spinning cotton imported into France, from England, by M. Morin, of Amiens.

1785. Power looms invented by Dr. Cartwright.

" Cylinder printing on cloths invented by Bell, and much improved by Lockett.

" Bleaching first performed with oxymuriatic acid, by Bertholett, in France.

1786. The discovery of bleaching with oxymuriatic acid introduced into Great Britain, by James Watt.

" Mr. Orr, of East Bridgwater, Mass., employed R. and A. Barr, from Scotland, to construct carding, spinning, and roving machines; and the Legislature of Massachusetts, to encourage the machinists, granted them 200 pounds, lawful money.

1787. Thos. Somers, an English midshipman, constructed a model of a spinning jenny in Mass, for which the state government granted him £20. These were the first machines constructed in the United States.

" First machinery to spin cotton put into operation in France.

1787. 108 bales of cotton imported into England from the United States.

" The first cotton factory in the United States was organized this year, at Beverly, Mass., and continued in operation about 15 years, making corduroys, bed-tickings, and cotton velvets. General Washington visited this establishment in 1789.

1789. A mule jenny constructed at Amiens, in France, with 280 spindles.

" Sea island cotton first planted in the U. S., and upland cotton began about this time to be raised for use and exportation.

" Samuel Slater arrived in the United States in November.

1790. Dec. 20th, Samuel Slater started the first machinery for spinning cotton in the United States, at Pawtucket, R. I., constructed on Arkwright's plan. Oct. 15th, 1791, specimens of his first yarn and cloth were sent to the Secretary of the U. S. Treasury.

" First calico printing in the United States commenced with wooden types by Herman Vandausen, a German, at East Greenwich, R. I.

1791. A society of wealthy individuals, under the auspices of ALEXANDER HAMILTON, were incorporated by the legislature of New Jersey, for the purpose of "*establishing useful manufactures.*" In May, 1792, the manufacturing town of Paterson, N. J., founded by this company. In 1794, their first cotton mill completed, under the superintendence of Peter Colt, Esq., and calico shawls and other cotton goods were printed there. In 1796, the company suspended their manufacturing operations. In 1814, the company revived and manufactures greatly extended there, by Roswell L. Colt, Esq. In 1822, Mr. John Colt commenced at this place the manufacture of *cotton duck*, with doubled and twisted yarn, without dressing or any kind of sizing.

1792. A self-acting mule invented by Mr. Kelly, of Lanark Mills, Scotland.

1793. The saw-gin for cleaning cotton invented by Eli Whitney, in the United States. His patent dated March 14th, 1794.

" Exportation of cotton from the United States to Great Britain begins to be important.

1797. Amos Whittemore, of Cambridge, Mass., invented his machine for cutting, bending, and setting card teeth.

1798. Tennant's bleaching powders invented, by Mr. Tennant, of Glasgow.

" First cotton mill, with machinery, built in Switzerland.

1799. First cotton-spinning machinery erected in Saxony.

1800. The jacquard, a most ingenious mechanism, to be adapted to a loom for weaving figured goods, invented by M. Jacquart, of Lyons, France. It may be adapted to any common loom, at an expense of about $40.

1800 or 1801. The entire stock of American cotton in Liverpool, *one bag.*

1801. Discharge work in calico printing successfully adopted by Messrs. Peel.

1803. First cotton factory built in New Hampshire.

1805. Power looms widely and successfully introduced into England, after many failures.

" Engraved wooden rollers, used for printing cottons; invented by Barton·

1806. Machine for dressing warps invented by Mr. Johnson, who was then in the employment of Messrs. Radcliff & Ross.

1807. New markets for cotton manufactures opened by the revolutions in Spanish America.

1808. New method of engraving or stamping with dies the cylinders for printing cloth, introduced at Manchester, by Locket. This method of engraving by means of steel dies was *invented* by Jacob Perkins, an American.

1808. William Mason, a skillful artist and inventor of machinery, born at Mystic, Conn.

1809. The first cotton factory in New York built by Doct. Capron, in Oneida county.

" The first power loom invented and patented in the United States by P. C. Curtis, of Oneida County, N. Y.

" Lace machinery much improved by Heathcott.

" British parliament granted Dr. Cartwright £10,000 for his invention of the power loom in 1787.

1810. Public attention drawn to the growing importance of cotton manufactures in the United States by Hon. Albert Gallatin and Tench Coxe, Esq.

1811. Machinery for making bobbin-net patented by John Burn, of England.

" Turkey red first introduced into calico printing by M. Koechlin, at Mulhausan.

1813. Discharging Turkey red with acid, in calico printing, patented by Jas. Thompson, F. R. S.

" Mr. Metcalfe, from America, sent to India with machines for improved cleaning of cotton.

" The first manufacturing establishment in the world combining all the operations necessary for converting the raw cotton into finished cloth, erected at Waltham, Mass., by Francis Cabot Lowell and Patrick Tracy Jackson, assisted by Mr. Paul Moody, an eminent machinist. The exportation of manufacturing machinery from England being prohibited by law, they contrived their own power looms.

1815. 8 lbs. cotton yarn sent from England to India on trial.

1816. Yarn trade opened between England and the continent.

" The first act of Congress passed having special regard to the growth and protection of manufactures in the United States. (The Tariff of 1816.)

" Cotton consumed by the manufactories in the United States about 11,000,000 lbs. per annum.

1817. Francis Cabot Lowell died, *æt.* 43 years

1818. Cotton averaged about 34 cents per pound—the highest of any year in the U. S. since 1801.

1819. New cotton lands sold very high in the United States.

1820. Steam power first applied with success to lace machinery.

" The first cotton mill erected in Manayunk, Pennsylvania, by Capt. John Towers.

1821. The site of the manufacturing city of LOWELL purchased by Patrick T. Jackson, Esq., on the suggestion of Mr. Ezra Worthen. On the 9th Feb., 1822, the Merrimack Manufacturing Company was incorporated. Same year the foundation of the first factory at Lowell was laid, under the agency of Kirk Boot, Esq.; and in November, 1823, the first cloth was produced under the superintendency of Ezra Worthen.

1823. The counter-twist, or Taunton speeder, invented by George Danforth, of Taunton, Mass.

" The first export of raw cotton from Egypt to England.

1824. Ezra Worthen died, June 18th.

1825. First calico printing machine imported from England to the United States, by Wm. J. Breed, of Providence, R. I.

" A self-acting mule spinner patented in England by Roberts. The tube frame introduced there from the United States.

1826. First exports of American cotton manufactures to any considerable amount.

1828. Charles Danforth, a native of Bristol Co., Mass., invents the cap spinner, or Danforth frame, patented in England in 1830, and there known as "The American Throstle."

1831. July 7. Paul Moody, an able inventor and improver of cotton machinery, died, aged 54.

1832. An important improvement in machinery for preparing cotton for the cards, called the Picker and Lapper, patented by John C. Whitin, of Mass.

1835. The number of factories, this year, in Great Britain and Ireland, were 1,263 at work, 42 idle.

1837. April 11. Mr. Kirk Boot died at Lowell, Mass.

1839. William Mason invented his self-acting mule. Took out a patent for improvements therein in 1843.

1841. American cotton planters employed by the British Government of India, for the improvement of cotton growing, arrive in that country.

1842. Power loom for weaving ginghams and checks invented by E. B. Bigelow, of Massachusetts.

1845. March 22. Duty on cotton repealed in England.

1846. England exported 157,130,025 lbs. of cotton yarn, valued at £8,133 772.

1847. Sept. 12. Patrick T. Jackson, founder of Lowell, died at Beverly, Mass., *æt.* 68.

1848. Cotton consumed by manufactories in the United States about 254,843,400 pounds per annum.

" Power looms introduced into Tuscany about this time by F. Padreddii, of Pisa.

1851. Great Exhibition in London of the works of industry of all nations.

OFFICERS AND TRUSTEES OF THE SOCIETY,

ELECTED, FEBRUARY 8, 1853.

BULLETIN

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FOR THE YEAR 1854.

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1854.

OFFICERS AND TRUSTEES OF THE SOCIETY,

ELECTED FEBRUARY 14, 1854.

Basin of the North Atlantic Ocean.

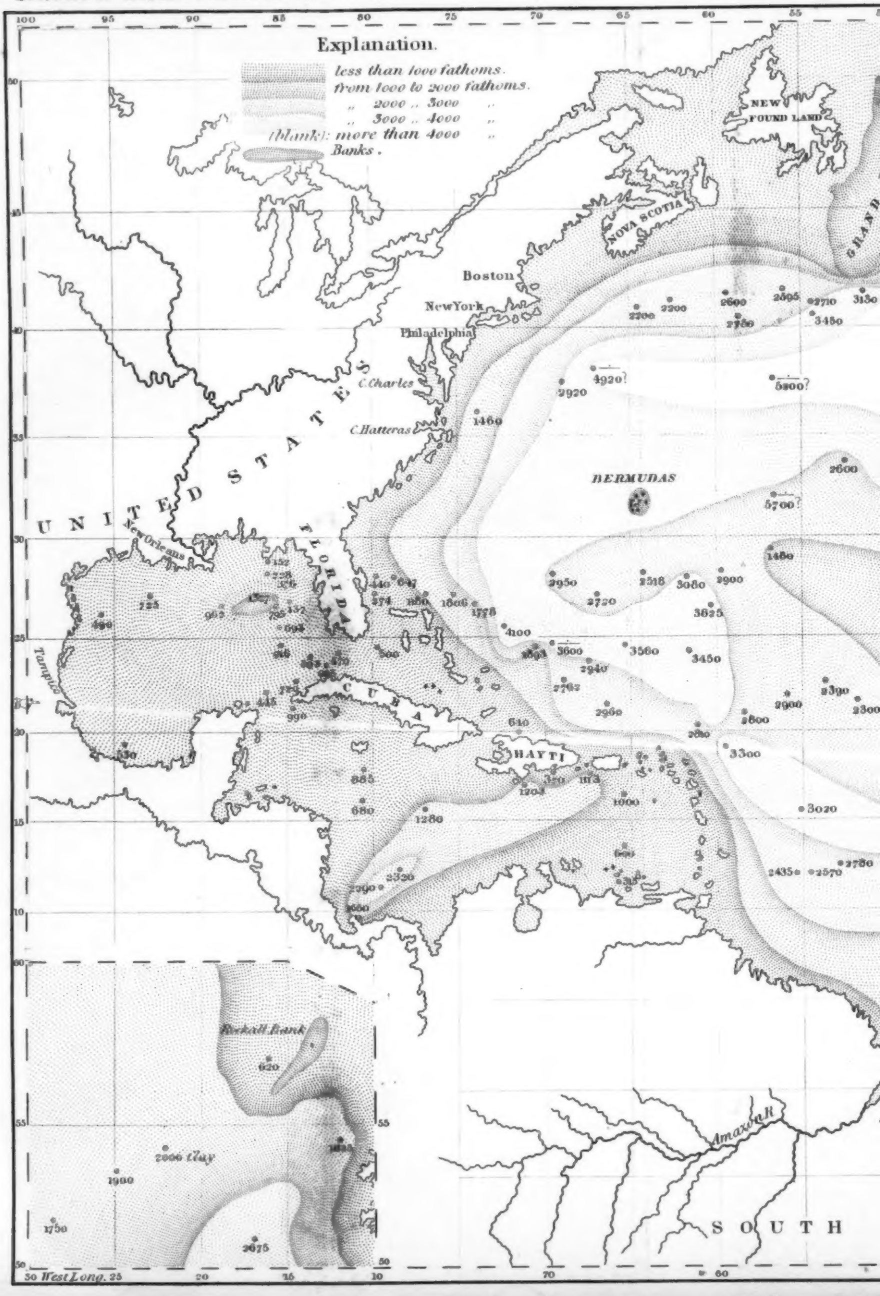
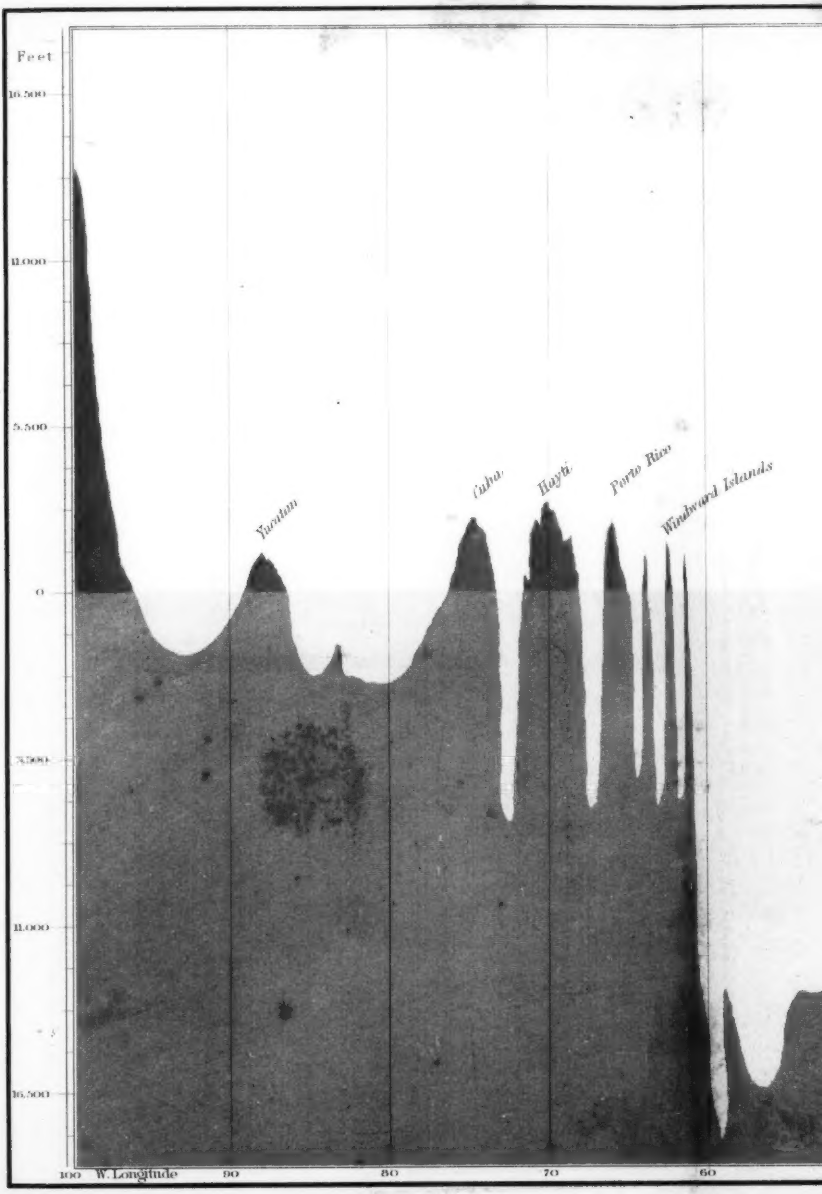
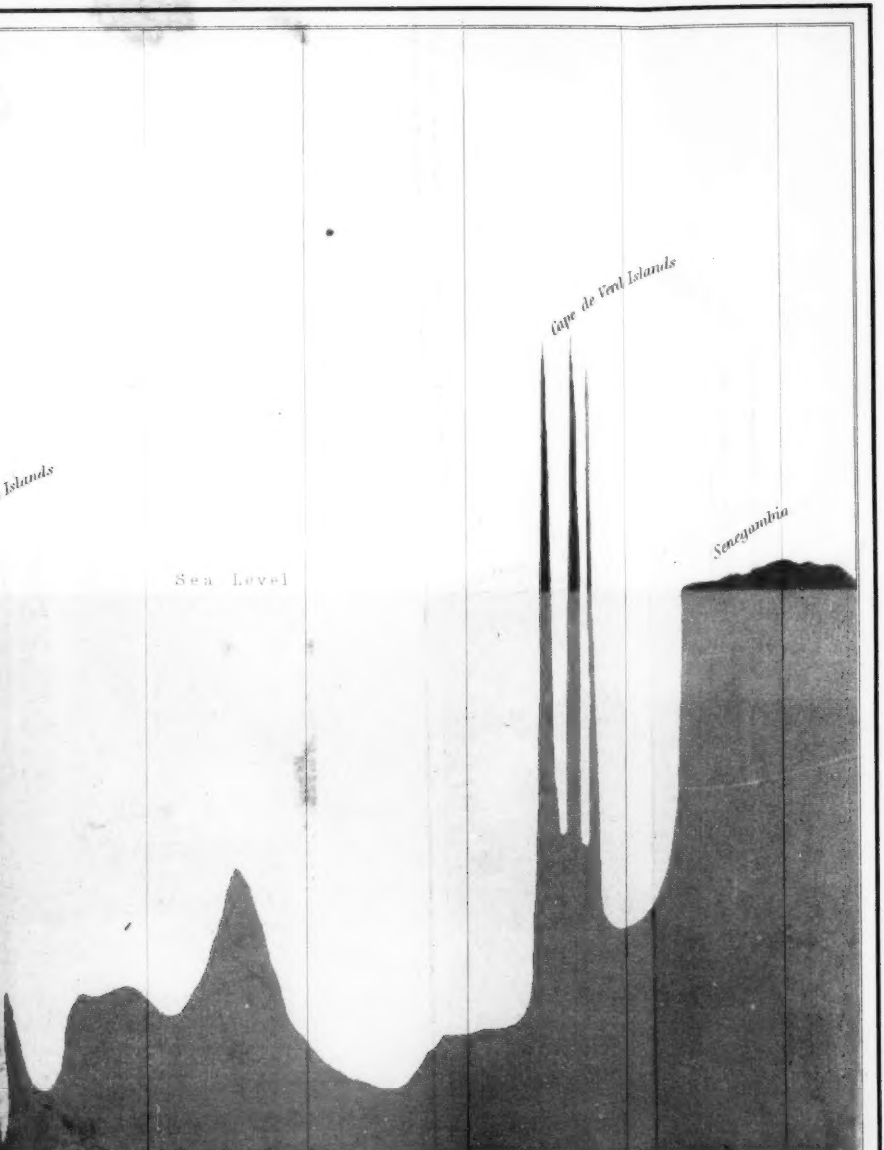


Plate XIV.

GRAND BANK
AZORES
MADEIRA
CANARY ISLANDS
CAPE VERD ISLANDS
PORTUGAL
Straits of Gibraltar
AFRICA
SOUTH AMERICA
S. Pedro
Vertical Section on Plate XV
Fig. A
Engraved & Printed by J.M. Butler Philad.

VERTICAL SECTION—





Engraved & Printed by J.M.Butler Philad[a]

TRANSACTIONS OF THE SOCIETY.

ANNUAL ADDRESS.

BY M. F. MAURY, L.L.D., LIEUT. U. S. N.

The following Address was delivered by M. F. Maury, L.L. D., Lieut. U. S. N., at the Annual Meeting of the American Geographical and Statistical Society, on Thursday Evening, Feb. 16th, 1854.

The return of the period for the Annual Address suggests a review, though brief, of the progress which has recently been made in the science which it is the especial object of the American Geographical Society to promote.

These annual addresses, and the impressions which they make in the history of societies serve, as we drift along down the stream of time, as landmarks, as points of departure, from which we may look back, and by looking back, judge the more wisely what tack to go upon, what new course to shape. The mariner watches the progress of his vessel from hour to hour upon the high seas. Although during the voyage, he constantly looks ahead to his port of destination, he does not forget occasionally to glance back to the haven whence he sailed, that seeing how far he has come, he may the better measure how far he has still to go. When the retrospect is satisfactory, it is also encouraging—for by cheering the spirit it helps one along. So too on occasions like the present, when the friends of human progress in this or in that department of knowledge meet

together at stated periods, it is good to glance back as well as to look forward. The co-laborers and friends in the cause of the American Geographical and Statistical Society are now assembled for the purpose of hearing the annual address of the society.

If we now pass, though never so hastily, in review, the progress that has been made in geographical discovery and improvement during the last year, the members of this society too, like the master of the well managed ship upon the trackless ocean, will, I have no doubt, derive encouragement from the retrospect, and enter upon the labors of the new geographical year with stouter hearts and braver minds.

The geographical problem that for ages has baffled the world, has been solved during the past year.

Though no ship has as yet actually made the North-West passage, yet navigators coming from the West, and navigators coming from the East, have met together, and shaken hands across the ice; Lieut. Cresswell, of Her Majesty's Navy, entering the Arctic ocean through Behring's straits in the "Investigator," has sailed, and travelled, and sailed, until to him belongs the distinction of having been the first to put a girdle round about this great continent of the new world.

Commander McClure, of Her Majesty's ship "Investigator," doubled Cape Horn in the spring of 1850, on a voyage to the Arctic regions, in search of Sir John Franklin and his companions.

Entering Bhering's Straits, he parted company with Her Majesty's ship "Herald," Capt. Kellett, off Cape Lisburne, July 31, 1850, and was last seen six days afterward on that side, standing to the Northward and Eastward with studding sails set.

There Kellett left him to return to England.

The next time he was seen was on the 6th of April, 1853, in the Bay of Mercy, by Lieut. Pim, who was serving under Kellett.

Thus Kellett and his officers were the last to bid McClure "God speed" on the West, and to give him the helping hand of welcome on the East

To McClure belongs the high honor of putting to rest this vexed question of a Northwest passage. On the 26th day of October, 1850, being on a travelling party, he established the fact that the Strait between Baring Island and Prince Albert Land, which he calls Prince of Wales Strait, and in which his ship was, connects

itself by water and ice, with Baffin's Bay, through Melville Sound, Barrow Strait, and Lancaster Sound.

This is the question that has vexed old England for centuries.

The problem of a short cut to "Cathay," of a passage to the East, is the most important geographical problem that has ever engaged the attention of enlightened, civilized societies. It was this problem that led to the discovery of the new world, and after this continent was discovered and portioned out among the Kings of the earth, a passage Westward to the Indies was still the grand problem. At this very moment the subject of a railway to the Pacific, of canals across the Isthmus, and their bearings upon that self-same land of Cathay, fill a large space in the public mind. So that we have not yet done with this interesting problem, though nearly four centuries have elapsed since it was first taken up.

If a *bona fide* Northwest passage, one that could be available at all times, and that would afford a passage to merchantmen, could really have been found, it would have placed England almost as near to China as she now is to the Isthmus of Panama. Accordingly, we find her, whenever, during the last 300 years, she has had a respite from war, pushing forward her expeditions for the discovery of this passage. Indeed, since the last European war, and during the long peace which has followed it, her efforts at a Northwest passage have been up to this hour almost incessant. All honor, therefore, to Captain McClure for having settled this question.

It is true the whales of the sea, in their mute way, had signified that there was a water communication from one side of this continent to the other, for we find the same kind of whale in Baffin's Bay that is found in Bhering's Straits, and know that the Torrid zone is to this animal as a sea of fire through which he cannot pass. The right whale of Bhering's Straits, it was proved, never could double Cape Horn or the Cape of Good Hope. In fact, he could not either cross over the Equator, or pass over into the Southern Hemisphere at all. Therefore, when the same whale that was found in Bhering's Straits was seen also in Baffin's Bay, the conclusion was almost irresistible that there was a Northwest passage and the whales knew of it.*

* "Whales harpooned in the Greenland seas, have been frequently caught in the Pacific," and vice versa.

"A Dutch Captain, Jacob Cool of Sardam was informed by the Fischal Zee-

The currents of the sea also had indicated that there was water communication from one side to the other.

And philosophers consulting the agents which control the winds, and studying the developments of nature, had gathered data from those regions, tending to prove the same thing. Yet, notwithstanding these probabilities, and this amount of circumstantial evidence, the question of an open sea in the Polar basin, has been left as a scientific question in the category of an unsolved problem.

McClure's track was for the most part along the coast, and, therefore, he could not throw much light upon the question of an open sea in the Arctic ocean.

But as for the Northwest Passage, money, time, and the lives of many gallant sailors had been offered up in the effort to find this communication. The problem was too important, the national mind of a self-relying and a proud people was too deeply interested, to admit, after such sacrifices, any other evidence as conclusive, short of that which appeals to the senses and comes within the category

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man of India, that a whale caught in the Sea of Tartary, had in his back, a Dutch harpoon marked, W. B., which harpoon was identified as belonging to William Bastiaanz, Admiral of the Dutch whaling fleet; the whale had been struck in the Spitzbergen Seas."

"In Müller's voyages it is related that the crew of a Russian discovery ship, while wintering on the west coast of Kamschatka, found on the beach the carcase of a whale, in which was a harpoon of European workmanship, marked with Roman letters."

"Hendrick Hamel in his *unfortunate voyage of the Yacht Sparwer*, corroborates Müller. He says that in the sea to the North East of Korea, they take every year a great number of whales, in some of which are found harpoons of the French and Dutch, who practise the fishery at the extremities of Europe; whence we infer (A. D. 1653) that there is surely a passage between Korea and Japan which communicates to the Strait of Weigatz, separating Nova Zembla from the continent of Europe."

"In 1813 a whale was killed by the ship Volunteer of Whitby, off Spitsbergen, in which was found part of a lance made of a hard grey *stone*, of a flinty appearance, about 3 inches long, 2 inches broad and $\frac{3}{16}$ of an inch thick; with two small holes, as if for the purpose of lashing the stock or shaft."

"In 1812, in the Spitzbergen seas, the Aurora of Hull took a whale having a harpoon of *bone* stuck in his back."

"The Esquimaux from their frequent intercourse with Europeans have long used iron implements; so that those of *stone* and *bone* must have belonged to some tribes on the unexplored Northern face of the American continent." *Scoresby's Arctic Regions.*

of proof positive. All honor, therefore, to Commander McClure and his gallant crew, who have wrung from the iceberg and barrier, from privation and danger, this proof. I hope, and I am sure this society will heartily join me in the wish, that, at our next annual address, your orator will have the pleasure of calling him "Admiral McClure," for I consider he has performed a most important work.

The geographical fact that he has established, viz:—that there is no practicable way through the Northwest to the "Indies" is, next to the discovery of a practicable way, the most important discovery that it was possible to make in those regions. Call it a negative discovery, if you please; negative results are to him who is in search of truth, sometimes in the importance of their bearings, equal to and altogether as reliable, as positive.

Cui-bono?

Does any one ask the question? Why, the energies of Great Britain—of the most powerful nation that has ever yet culminated in its greatness, have been directed to a passage there. And they have been directed with an intensity and with an interest that have diverted the mind of a great people from other and perhaps more utilitarian enterprises. The money which that nation has expended from first to last in the search of that passage would, with its interest, nearly suffice now to connect the two oceans by a canal across the Isthmus. Her own officers have at last demonstrated that there is no practicable route to the North West. The attention, therefore, of that great nation and people will now, no doubt, be as earnestly directed to some practicable route, either by railway or canal across the continent, as it has been to an impracticable route.

The North West passage is a subject which has, from peculiar circumstances, occupied a large share of attention before this Society. Its Vice President has been munificent towards it. He has fitted out an expedition for search and discovery there, which has made his name respected and revered wherever true nobleness is admired or deeds of humanity cherished.

British officers and the British Admirality have been charged, in the hearing of this Society, with wrong to this expedition.

The claims of Lieut. De Haven, it was alleged, have not only not been acknowledged in England, but the credit due for the discoveries of this expedition has been taken away from those on this

side of the water, to whom honor is due, and given to those on that, who, rightfully, have neither part nor lot in the matter.

These charges were made by a member of this Society,* and not without show of reason; for I hold in my hand a chart published on the 14th of October, 1853, at the Hydrographic Office of the Admirality, entitled,

"CHART Showing the North West Passage, Discovered by H. M. "Ship Investigator; also the Coast Explored in Search of Sir "John Franklin, by Sir James Ross, 1848-49; Sir John Richard- "son, 1848-49; Capt. McClure, 1850; Capt. Austen, 1850; Mr. "Penny, 1850; Mr. Rae, 1851; Mr. Kennedy and M. Bellot, 1852; "Capt. Inglefield, 1852-53; Capt. Sir Edward Belcher, 1852-53.

"By E. A. Inglefield, Commander, H. M. Ship Phœnix,—Hydro- "graphic Office, Admirality, 14th October, 1853."

In this chart Lieut. De Haven and the Grinnell Expedition are ignored, and the discoveries made by them, given to Penny and Belcher.

The mere appearance of wrong from such a quarter, to an expedition fitted out under the circumstances which characterized the Grinnell Expedition, could not fail to attract the attention both of the government and people of the United States.†

It is a misfortune that matters of scientific concern should ever serve to excite international controversy, or whet popular jealousies and national animosities.

Men of science, as such, know no internationality. They owe allegiance to but one power, and that is TRUTH; and they are all fellow-citizens alike of the great Republic of Science.

That any British officer, from the highest Admiral down to the youngest mid-shipman could find it in his heart to do any one the slightest wrong in the matter of this Grinnell Expedition, I never could imagine.

I am, therefore, the more happy to announce to this Society, that last night a newly revised Admirality Chart was placed in my

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* See paper entitled "Grinnell Land" read before the National Institute, Washington, in May, 1852, by Col. Peter Force; also paper entitled, "Supplement to Grinnell Land," read before National Institute, July, 1853, by Col. Force.

† See remarks upon it made by the Secretary of the Navy in his last Annual Report to Congress.

hands by a friend. It is entitled, "Discoveries in the Arctic Sea up to 1853," and has the stamp of the Hydrographic Office of Great Britain upon it.

Its actual date of publication is, I take it, subsequent to that of October, to which I have just alluded.

I have not had time to examine this new chart thoroughly; but as far as I have had an opportunity of looking over it, it gives me pleasure to say IT IS ALL RIGHT, with the single exception of the Grinnell Land and Mount Franklin of De Haven.

The Grinnell Land of De Haven has been on former Admirality charts, called Prince Albert Land. On this chart, the name "Prince Albert Land" is omitted, but the name of Grinnell Land has not been restored.

I think it ought to be restored.

Mount Franklin was never reached by De Haven. It was simply seen bearing N. N. E. in the distance from the highest point in latitude reached by him. Whether it was 20 or 60 miles off, he knew not.

On this revised Admirality chart, it is placed upon the shore of Wellington Channel, notwithstanding that Belcher reports as he went along up that channel, that he saw nothing of the Mount Franklin of De Haven on that shore.

But doubling around the peninsula which separates Wellington Channel from Jones' Sound, he traveled in a south-eastwardly direction, and ascended a mountain 1500 feet high on the opposite side of this peninsula.

This, I have no doubt, is the Mount Franklin of De Haven. It is in the direction that he gives it from the highest point of latitude reached by him; and as to its existence, he has said to me over and over again, "There can be no doubt, for it was as palpable before my eyes as your face now is. How far it was from me I cannot say, but far or near, upon that N. N. E. line it stands, and there it will be found by whomsoever it may be sought."

There is no evidence that there is any elevation deserving the name of 'Mount' on the Wellington side of this peninsula, where this chart places the Mount Franklin. But upon the true line of bearing described by De Haven, a Mount has been found. I think, therefore, that Belcher's "Elevation of 1500 feet" on this chart is

2

what De Haven saw and named in honor of the lost navigator, and that it ought to be so called on all charts.

I have deemed it a duty to the science to which we render homage, to say thus much upon this subject. For I am sure all that is necessary to cause the Admiralty chart of October, 1853, to be entirely suppressed, and to cause what is right to be done touching the Grinnell Land and Mount Franklin on the more recent charts, is to invite in a truth-loving spirit, the attention of the Royal Geographical Society, or any other English authority, to the subject.

That Society, like the great body of the English nation, is composed of men who love right and hate wrong, and in whose sense of justice I have great reliance.

I congratulate the Society upon the activity that has been and is now displayed by our own government and fellow citizens in the various fields of geographical research. Kane of the Navy is now on a second expedition to the Arctic regions in search of Sir John Franklin, and of geographical lore. That expedition was, I may say, started here in this Society, and therefore, I need only remind you that our latest intelligence from it was 20th July, 1853, when it had safely arrived at Upernavik.

In 1850, Lieut. Wm. L. Herndon, United States Navy, was sent to explore the valley of the Amazon. He was directed to cross over the Andes from Lima, and reaching the head waters of that river, he was to follow it to the sea.

The object of this expedition was eminently practical and highly important. It was to ascertain the present resources and future capabilities for trade and commerce of that magnificent water-shed.

His Report has been published by order of Congress, and it will be found one of the most interesting, instructive and valuable documents of the day. He ran a line of soundings from the sources of the Amazon, among the mountains to its mouth under the line, and found it navigable for vessels of the largest class, from the sea to the base of the Andes, a distance of nearly 3,500 miles. This expedition, beside the notes of its leader, brought home a valuable collection consisting of specimens of the *flora* and the *fauna* and other matter, illustrative of the physical geography of that most interesting region of country. These have not been described for want of funds—$2,500. Surely the government will furnish this

sum, for if this collection were worth sending for, it is certainly worth description.

There is a close relation between the fauna and the flora of every country. The animal kingdom is based upon the vegetable, and the flora, if you please, may be considered as the resultant of meteorological agencies—of heat and cold, of clouds and sunshine, of rain, dews, and the hygrometrical relations generally of the atmosphere. Now whatever is calculated to throw light upon these conditions, has a bearing upon your favorite science, for the fauna and the flora of a country constitute the most striking features in its physical geography.

The capacities of the country drained by the Amazon, to sustain population, are thought to be the greatest in the world, and with a population equalling that of Belgium to the square mile—that river basin includes an area that is large enough to sustain a population of *Six Hundred Millions.* Its seed time is perpetual, its harvests never end, and its capacity to sustain population, has been computed to be fourfold that of Belgium.

The winds and currents of the sea, are such as to place the Atlantic ports of the United States on the wayside of all nations, either going or coming from the mouth of the Amazon. Therefore there is no region of country beyond our own borders, the physical geography of which is more interesting to the people of the United States.

Commerce, or rather produce, the basis of commerce, may be regarded as one of the exponents of physical geography; for explain to me the physical geography of a country, and I will tell you of what productions it is capable. In this sense, therefore, all that relates to the physical geography of the Atlantic slopes of South America, is calculated to be peculiarly interesting to the American citizen, because it has in the future such powerful bearings upon the commerce of his country.

One of the most striking features about the Amazon is well described by a sailor boy that belonged to Herndon's expedition. It bears upon the geography of that country, because it is illustrative of its present condition, and therefore I may be excused for quoting it.

Richards is a young man, who, without the advantages of a liberal education, had been brought up on a farm in Virginia. He

had shipped on board the U. S. frigate Raritan for a cruise in the Pacific. Leaving that ship he joined Herndon's party in Lima. He had seen the waves in their majesty, and the storm in its grandeur off Cape Horn. In his voyage to the Amazon, and across the Andes, he had visited the famous quicksilver mines of Huancavalica and had walked through its modern monolithic caves, whose pink-stained arches, groins and columns are of the richest and most beautiful cinnabar. He had seen the Lake of Indian myths—the classic Titicaca of the Incas—and crossed the river Desaguadero, running from it, and which the natives assured him, sometimes running back up stream, empties into it. He had crossed the Andes where the scenery was wildness itself.

Descending their Eastern slopes, he had been enabled at one view to comprehend the whole range of the vegetable gammut from the regions of eternal snow on the mountain peaks, to the luscious climes of everlasting Summer in the plains below. And in these plains he had seen the vegetable kingdom rioting in new forms and teeming with new fruits—a tree whose fruit is bread, standing to the native in place of a bakery; another, which, with its juice, performs to him the office of a cow; and another, whose nuts stand him in the stead of candles; and another that grew and flourished in spite of the "Maine Liquor Law," for it was itself a natural distillery. These were things, and objects, and scenes, well calculated to make powerful impressions upon a mind like Richards', and wondering which of them had made the strongest, I said, "pray, Mr. Richards, what of all that you have seen during this most interesting expedition struck you as being the most strange?" "What struck me as the most strange and wonderful?" "Yes." "Why, that such a country, as is the valley of the Amazon, should in the middle of the 19th century, be a wilderness."

To the glory of the Republic, be it said, no moves by the State are hailed with more enthusiasm by the popular voice than those which have for their object the opening up by the lights of science and the arts of peace, of new fields to commercial enterprise or the extending of those already opened. It is to be hoped that we may soon see properly equipped expeditions steaming up the Amazon, and its magnificent tributaries, for exploration and discovery; for Herndon was necessarily so restricted as to equipment,

that he could do but little more than one can who should undertake to drift down that river on a log.

Some of the strongest contrasts in geography are perhaps to be found in the region of country drained by this mighty river. The late General Illingworth, an Englishman, and a soldier of great worth, who joined the patriot cause of South America at its dawn, and who died but a few months ago, holding the office of Secretary of State in the Republic of Ecuador, mentions in a letter written not long before his death, one of those mountain, plain, sea and river contrasts, the like of which is, perhaps, nowhere else to be seen. In speaking of the Amazonian tributaries of Ecuador, he says:

"I cannot, however, but repeat here that a singular topographical phenomenon presents itself in the Ecuadorean section of the Andes. At the back, or to the eastward of Ambato, some unknown convulsion of nature has broken the chain of the Cordilleras, and opened a vast gap or chasm from West to East; where the deep stream of the Pastaza is formed, receiving the waters of the peopled districts of Riobamba, Ambato and Latacunga. It may be supposed, therefore, that a person on an elevated point near Ambato, and with a favorable atmosphere, might see the Pacific ocean and the course of the tributary Pastaza, descending through the Amazon to the Atlantic ocean. In the month of September, 1821, and on an elevation a few leagues to the westward of Ambato, I had the pleasure of viewing the above mentioned gap in the Andes, and on facing to the westward, I beheld for a full quarter of an hour the line of our coast, the Island of Puna, and the dark-blue shade of the Pacific ocean. The sun was setting and the evening clear."

There, with the waters of a navigable river, at his feet, coursing down to the Atlantic on one hand, he saw on the other, the island of Puna in the gulf of Guayaquil, the great South Sea, and the Pacific shores of his own litttle Republic.

Lieut. Page, in the U. S. steamer Water Witch, with a complement of most excellent officers, is engaged in an exploration of the Rio de La Plata and its tributaries. This river is the Mississippi of the Southern Hemisphere. Lieut. Page is well supplied with instruments and means. He has with him a photographic apparatus, with all the appliances which ingenuity has lent to modern

geographical research. He and his officers know what to do with them. They love work and rejoice in their mission. I expect, therefore, when his survey is done, that we shall know much about the basin of that river, its commercial resources, active and dormant, its present capabilities and future capacities—in short, that the geography, in its widest sense, of that great hydrographic basin, will be then quite as well understood as that of our own Missouri.

My last letter from him is dated October 1st, 1853. He was then with his steamer at the City of Ascencion, on the Paraguay river. He had not found a single bar, sand bank or sawyer, to interrupt his progress. On the contrary, he carried twenty feet of water up to the city, which is farther from the mouth of the Rio de La Plata than St. Louis is from the mouth of the Mississippi.

Lieut. Gilliss, U. S. N., is preparing for publication his labors as the Director of the Astronomical expedition to Chili. He is an officer of the most untiring industry, and we may expect from him valuable contributions to our knowledge touching the geography and statistics of that interesting country.

Lieut. McRae, one of his associates, who returned to the United States by crossing the Pampas of Buenos Ayres, has gone back to make further investigations. He too, will in due time, be ready with his mite to cast it into the common geographical treasury of the world.

Lieut. Chas. H. Davis is diligently at work with the second number of the American Nautical Almanac. That work so creditable to its conductor, so honorable to the country, so beneficial to its commercial and navigating interests, will be mighty in the cause of geographical science. That other great geographical problem, which has engaged the attention of the world as long as the Northwest Passage—and has been a day dream with the men of England, has not escaped the attention of government in these stirring geographical times.

The project of a ship canal across the Isthmus of Darien, has been renewed, and it is about to be presented to the world, under more favorable auspices than it has ever yet been. Lieut. Strain, U. S. N., sailed last December, with an excellent corps of young officers in the U. S. steamer Cyane, for the purpose of examining that route thoroughly. There is, therefore, in store among the

labors of that party, another valuable contribution to the general stock of human knowledge.

Anchoring in Calidonia Bay, on this side, he will, from that beautiful sheet of water, enter the valley of the river Calidonia, which discharges there, and tracing this water shed to the "divide" between the two oceans, he will cross over and descend through the valley of the Savannah river to the Bay of San Miguel—another fine harbor through which the waters of this river reach the great South Sea.

America has done but little for the geography in one sense, of the "grand ocean," as some of the early navigators called the Pacific, since Lieut. Wilkes was there about fifteen years ago. But fresh instalments to the geographical treasury of the world, are already on their way home from those regions, and a new expedition is on its way out for more.

Commodore Perry, with his accustomed energy, has already had surveys made of several important places in the East, among them, the harbor of Jeddo, which is described by his officers as one of the boldest, and most beautiful sheets of water in the world, not excepting the harbor of San Francisco, or of Naples, or of Rio, nor your own lovely bay. "We ascended," says Lieutenant Bent, of the Mississippi, in a private letter, "to within about seven miles (in a straight line) of Jeddo, carrying from 40 to 17 fathoms water all the way. This was nineteen miles nearer the capital than any foreign vessel had ever previously been. This occurred after the reception, (of which I will speak presently ;) and as everything had gone on very successfully, the Commodore did not wish to do anything that would militate against the advantages we had obtained, or he would have gone, I imagine, in sight of the city, which was hidden from us only by a point of land some three miles ahead.

"This is the finest sheet of water in the world, not excepting Rio and San Francisco. Thirty-five by twenty-five miles in diameter, surrounded by numerous snug coves and most lovely shores, it contains not a single island except close along its borders, and seems perfectly clear from obstructions of any kind to navigation. It connects with the ocean by a strait, ranging from ten to fifteen miles in width and forty fathoms in depth." He is constructing a chart of that harbor.

Ringgold with his squadron has, just about this time, entered

fairly upon the field of his operations, which includes the North Pacific Ocean, with its arms, straits and gulfs. That is the largest surveying squadron now afloat under any flag. And never has any nation sent forth an expedition in the cause of science better fitted and found than that is. For accurate work and practical results it has with it all the means and appliances that government in the indulgence of an enlightened liberality could suggest, or that science, ingenuity and the improvements of the age could bestow. His squadron consists of five vessels. He is assisted by a corps of young and accomplished officers who have entered upon this service with him *con amore.*

These constitute the element of success. We may expect, therefore, in the course of the next three years much valuable information concerning the North Pacific Ocean, for discoveries and results as fast as made and obtained are to be sent home to the Hydrographical Bureau of the Navy for publication.

Thus we have, or will have, to enrich our archives, De Haven and Kane in the frozen sea; Strain and Herndon with Gibbon his companion, in the Torrid Zone; Perry and Ringgold in the East, with Page and Gilliss and McRae in the West.

Nor should I forget the line of deep sea soundings, especially, which was run last summer by Lieut. Berryman, commanding U. S. brig Dolphin, from the neighborhood of Newfoundland to that of Ireland. That line has important and practical bearings upon the question of a submarine telegraph between Europe and America. There is bottom for it.

From Newfoundland to Ireland the distance between the nearest points is about 1,600 miles, and the bottom of the sea between the two places is a plateau which seems to have been placed there especially for the purpose of holding the wires of a submarine telegraph, and of keeping them out of harm's way. It is neither too deep, nor too shallow. Yet it is so deep that the wires being once landed will remain forever beyond the reach of vessels, anchors, icebergs, and drifts of any kind; and so shallow that the wires may be readily lodged upon the bottom.

The depth of this plateau is quite regular, gradually increasing from the shores of Newfoundland to the depth of from 1,500 to 2,000 fathoms as you approach the other side.

The distance between Ireland and Cape Charles or Cape St.

Louis in Labrador, is somewhat less than the distance from any part of Ireland to the nearest point in Newfoundland.

I do not pretend to consider the question as to the possibility of finding a time calm enough, the sea smooth enough, a wire long enough to carry and lay a coil of wire 1,600 miles in length; though I have no fears but that the enterprise and ingenuity of the age, whenever called on with these problems, will be ready with a satisfactory and practical solution of them. I simply address myself at this time to the question, in so far as the bottom of the sea is concerned; and as far that the greatest practical difficulty will, I apprehend, be found after reaching soundings at either end of the line, and not in the deep sea.

A wire, laid across from either of the above named places on this side, would pass to the north of the Grand Banks, and rest on that beautiful plateau to which I have alluded, and where the water of the sea appears to be as quiet, and as completely at rest as it is at the bottom of a mill-pond.

It is proper that the reasons should be stated for the inference that there are no perceptible currents, and no abrading agents at work at the bottom of the sea upon this telegraphic plateau.

I derive this inference from the study of a physical fact, which I little dreamed when I sought it, had any such bearings.

It is unnecessary to allude here to the rich germs which physical facts, apparently the most striking, are often found to contain. That great achievement which has harnessed the lightning and made one of the imponderable agents of the universe a messenger for man, has its root in the little physical fact that was first observed by a philosopher with regard to the legs of a dead frog.

So too with regard to these deep sea soundings, and the carefully labeled specimens from the bottom. When asked, as I have often been, for the *cui bono* touching that last, I have found myself under the necessity of answering the question, by asking, with Franklin, "what is the use of the newborn babe?"

Berryman brought up, with Brooke's deep sea sounding apparatus, specimens of the bottom from this plateau.

I sent them to Prof. Bailey, of West Point, for examination under his microscope. This he kindly gave them, and that eminent microscopist was quite as much surprised to find, as I was to learn, that *all* these specimens of deep sea soundings are filled with

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microscopic shells. "*Not a particle of sand or gravel exists in them.*"

These little shells, therefore, suggest the fact that there are no currents at the bottom of the sea whence they came; that Brooke's lead found them where they were deposited in their burial place, after having lived and died on the surface, and by gradually sinking were lodged on the bottom.

Had there been currents at the bottom, there would have swept and abraded, and mingled up with these microscopic remains, the debris of the bottom of the sea, such as ooze, sand gravel, and other matter. But not a particle of sand or gravel was found among them. Hence the inference, that those depths of the sea were not disturbed, either by waves or currents.

Consequently a telegraphic wire, once lodged there, there it would remain as completely beyond the reach of accident as it would if buried in air-tight cases.

Therefore, so far as the bottom of the deep sea between Newfoundland, or the Northern Cape at the mouth of the St. Lawrence, and Ireland is concerned, the practicability of a submarine telegraph across the Atlantic is proved.

But while the Navy has been thus occupied in winning laurels as green—may I not say as *green*, because they are won in times of peace and in the cause of knowledge and of truth, in the advancement of science and in aid of that progress which is upward and onward—may I not, therefore, say as GREEN as any with which it is possible for the hand of grim-visaged war to deck the brows of victors in his battles of heroes in his cause?

But while the Navy has been thus busied abroad, the Army and other branches of the public service have not been idle at home: The Coast Survey is a long established institution. A report of its proceedings is annually made to Congress. Gentlemen are familiar with the value of its labors, and therefore it is only necessary in this connection to refer to it as an establishment that has done and is doing much for those departments of knowledge which it is the especial object of this society to cultivate.

In the same category comes the Hydrographic Survey, by the Army, of the great American Lakes. That work, too, is being pushed forward even with more than its wonted vigor. It has already enriched one department of geography with an important

discovery. You know it has been said that the bottom of Lake Huron especially, was far below the level of the sea: Capt. Macomb informs me that nowhere in that lake has he been able to find water more than 420 feet deep, which places the bottom of that lake far above the surface of the sea.

The Mexican Boundary Commission is busily engaged in bringing up its results.

Besides these there are various parties at work exploring routes across the wilderness for the great Pacific Railway. Lieutenant Williamson is on the Pacific slope running his lines with the spirit level and the theodolite. Gov. Stevens is at the North, Lieut. Whipple is at the South; and Gunnison—alas poor Gunnison! was in the middle.

Science has its achievements and peace its triumphs, yet how much does it not sometimes cost to win them? Lieut. Bellot, of the French Navy, upon the ice of the Polar basin, Lieut. Gunnison, of the American army, upon the great "divide" which separates the waters of the Atlantic from the waters of the Pacific, have each fallen victims to the cause of that science whose achievements we celebrate. Though far apart they were fellow-laborers in the same cause. They both were in search of a commercial route to Cathay.

Two more gallant spirits, two men more richly endowed with the accomplishments of officers, and the qualities of gentlemen, never fell before the ruthless hand of the savage, or the remorseless billows of the sea. The English have resolved to erect at Greenwich a monument to Bellot. Shall we be less mindful of our own than they are of strangers? No. Let us resolve, when this railroad is finished, to erect in the middle of it, and on some towering mountain peak, a monument to that gallant young soldier. Place it on the summit of the highest hill top, where it may catch the first rays of the morning sun as he rises from the Atlantic, and where his parting beams as he sinks to rest in the Pacific, may linger longest.

Nor should I omit to mention among the valuable labors of the officers of the army, the very successful and interesting exploration of the Zuni river by Captain Sitgreaves, U. S. Army, and his party. Much of the ground that this officer travelled over is new.

Besides these, Fremont and Beale, have also been striving with

the Indians, and struggling with the snows of that great "divide," the latter with that daring and gallantry which has challenged our admiration on former occasions, the former with a degree of zeal and energy that has seldom been equalled, never surpassed.

We owe to him much of our geographical information concerning that region of the country, and he has made contributions which have been acknowledged and appreciated wherever geography is cultivated as a science. An enthusiastic amateur, that brave explorer is now there at his own risk and expense for the purpose of solving certain questions which in his former expeditions he was unable to resolve.

From this hasty review of what has been recently done and of what is doing for geography by the government and the people of the United States, it appears that few countries have ever at any time been able to boast of more activity in this department of scientific research and discovery. And which of these expeditions has not the public mind followed with interest and pleasure and profit? To the honor of our free institutions and of a free people, be it said, not one. The popular will is in favor of them all.

But though much has been done, these researches and these expeditions have, as they have made their advances, served to extend the horizon, have given us new lights, and show us that much yet remains to be done. Prominent among the *agenda* of this society during the coming year, is to foster by its influence and its counsels another expedition up the Amazon like Page's in the La Plata. The Amazon is at our own doors and we begin with it. I shall only allude to one other which cannot fail to commend itself to the good offices and favorable consideration of this Society, and that is the exploration of the valley of the Amour in Mantchouria. This river I believe belongs to Russia, though its navigation was ceded to China by Peter the Great in 1689. That was before modern science and enterprise could have been brought to bear upon it; consequently, unless a party be sent to explore it from some of the states of Christendom, it will continue to rest in its present darkness for other centuries.

"In almost every point of view," says Findlay, in his directory for the Pacific Ocean, published in 1851, "the Amour is the most valuable stream in Northern Asia. Of all the large rivers of that boundless region it is the only one that empties itself into a navi-

gable part of the universal ocean. It is, in fact, the only highway of nature that directly connects the central steppes of Asia with the rest of the world. But the political arrangements of man have decreed otherwise; and at this moment the Amour is infinitely less useful as a channel of traffic than almost any one of the land-locked rivers of Siberia. The navigation of the Amour was given, it is understood, for the privilege of holding a fair at Kiakhta, or establishing a factory at Pekin, which, according to Sir George Simpson, has turned out a poor compensation for the loss of this valuable artery to Central Asia; and by which cession the Russian possessions of Kamschatka and the islands beyond are reduced to half their value.

The researches concerning the winds and the currents of the sea, which have been carried on at the Observatory, enable me to say that the climate of that river basin corresponds to that of our lake basin, including the valley drained by the St. Lawrence, the Hudson, and the rivers of the New England States generally. And what the commerce between these states and river basins with Europe is, such may be and, in time, will be the commerce between the Amour and the Pacific States of this Union. China is in a state of revolution, and one of the first things after the revolutionists get firmly seated in power, will be, no doubt, an attempt on the part of the United States to form a commercial treaty with that people upon more liberal principles. And that this treaty might be made with eyes open, how important is it that our diplomatists should have full and complete information as to that immense Amour country, as to the navigation and navigability of that river, and as to its present capabilities and future capacities for trade and commerce. It is to be hoped that the enlightened Statesman at the head of the Navy Department will, ere long, feel himself at liberty to organise such an expedition.

There has been set on foot during the last year another move by the United States, which, in the judgment of many, is calculated to have important and wholesome bearings upon the physical geography of the world. I allude to the Maritime Conference at Brussels, which was held by invitation of this government, and in which were represented, in the persons of twelve delegates, the principal maritime powers.

The labors of those twelve men as they sat in conference around

the table at Brussels had, for their object, to convert every well appointed ship as she sails across the ocean, into a floating observatory, and to unite the whole sea-faring world into one general system of physical research. And thus an attempt, a well directed attempt, has been made to bring the sea regularly within the domains of philosophical research. But the atmosphere embraces the land as well as the sea. It is a whole, and as such, its agencies, its phenomena, and its laws ought to be studied. And why should not the same concert of action and uniformity of observation which Holland, and Denmark, and Spain, and Portugal, Sweden, Russia, Norway, Belgium, Prussia, England and the United States have agreed, at the recommendation of the Brussels Conference, to extend to the sea,—why should not the same uniformity and concert be extended also to the land?

It is now proposed to convoke in Brussels a general Meteorological Congress, which shall consist of one or more delegates from every Christian nation, and that it shall be the duty of this assemblage to devise a plan of meteorological research, which, including both sea and land, may become universal. Quetelet and Kreil, Hanstein, Kupffer, Buys Ballot, Airy, Secchi, Lamont, Sabine, James, and Jansen, and Beechey, with a host of others, have expressed themselves in favor of it.

But, for it to commend itself to the favorable consideration of this society and to its active supporters, it is only necessary to say that the proposition is one which promises many highly important and useful results. Nor does it call either upon the government or individuals for any heavy expenditure.

As a consequence of the discoveries to which the investigations made by the Navy, touching the phenomena of the sea have given rise, a new department of science has been added to the stores of human knowledge Perhaps the expression is too strong; therefore, I will say the corner stone for a new department of science has been laid, and I quote Humboldt for authority.

According to that great and wise man, a new branch of science has recently sprung up on this side of the water. It is styled Physical Geography of the Sea, and to the American Navy he ascribes the honor of originating it. As some of the first fruits of it, I have the pleasure of exhibiting to you two plates,* one show-

* Vide Plates XIV and XV, 6th Edition Maury's Sailing Directions.

ing the shape of the basin which holds the waters of the Atlantic. This delineation is to the solid part of the earth's crust, which is under the water, what a map of the country is to its mountain ranges and other contrasts on the same solid crust above the sea level. The other is a vertical section from one side of the Atlantic to the other. These two delineations are the results of deep sea-soundings made by officers of the Navy.

These soundings were at first unsatisfactory, because the plan upon which they were conducted never contemplated bringing up the plummet; indeed to bring it up from great depths was considered impracticable; therefore there was an uncertainty about them; —there was a feeling in the public mind of vagueness with regard to their results. How do you know that the plummet has reached the bottom? Let us have specimens—was the cry.

In this stage of the undertaking, a clever young officer of the Navy—Passed Midshipman J. M. Brooke, who was at the time serving with me at the Observatory, came to my relief, and supplied by his ingenuity the very desideratum which was so much wanted. He arranged a deep-sea sounding apparatus, so that when the plummet struck the bottom, it would become detached from the line, leaving attached to the latter a small iron bolt, which would bring up specimens from the bottom.

Last Summer and Fall Lieut. Berryman, of the Dolphin, gave this apparatus a fair trial, and brought up with it specimens from the bottom at the depth of 12,000 feet. Samples of these specimens were sent to Professor Bailey, of West Point, for examination under his microscope. He kindly undertook the study of them, and as his letter, reporting the result, is short, perhaps you will permit me to read it:—

West Point, Nov. 29, 1853.

"My Dear Sir—I am greatly obliged to you for the deep soundings you sent me last week, and I have looked at them with great interest. They are exactly what I wanted to get hold of—the bottom of the ocean at the depth of more than two miles! I hardly hoped ever to have a chance of examining—yet, thanks to Brooke's contrivance, we have it clean and free from grease, so that it can at once be put under the microscope. I was greatly delighted to find that all these deep soundings are filled with microscopic shells; not a particle of sand or gravel exists in them. They are chiefly

made up of perfect little calcareous shells (Foraminifera,) and contain, also, a small number of siliceous shells (Diatomaceæ.)

It is not probable that these animals lived at the depths where these shells are found, but I rather think that they inhabit the waters near the surface; and when they die their shells settle to the bottom. With reference to this point, I shall be very glad to examine bottles of water from various depths which were brought home by the Dolphin, and any similar materials, either 'bottom' or water from other localities. I shall study them carefully. * * The results already obtained are of very great interest, and have many important bearings on geology and zoology. * *

I hope you will induce as many as possible to collect soundings with Brooke's lead in all parts of the world, so that we can map out the animalculæ as you have the whales. Get your whalers also to collect mud from pancake ice, &c., in the polar regions—this is always full of interesting microscopic forms."

Truly, these results are suggestive: they seem to form but a slender clue, indeed—do these little mites of shells, by which the chambers of the deep are to be threaded and mysteries of the ocean revealed; yet in right hands and to right minds, they are sure guides to both light and knowledge.

The first noticeable thing the microscope gives of these specimens is, that all of them are of the animal, not one of the mineral kingdom.

The ocean teems with life, we know. Of the four elements of the old philosophers—fire, earth, air and water, perhaps the sea most of all abounds with living creatures.

The space occupied on the surface of our planet, by the different families of animals, and their remains, is inversely as the size of the individual.

The smaller the animal the greater the space occupied by his remains. Though not invariably the case, yet this rule, to a certain extent, is true, and will, therefore answer our present purposes, which are simply those of illustration.

Take the elephant and his remains, or a microscopic animal and his, and compare them. The contrast, as to space occupied, is as striking as that of the coral reef or island with the dimensions of the whale. The graveyard that would hold the corallines is larger than the graveyard that would hold the elephants.

As Professor Bailey remarks, the animalculæ, whose remains Brooke's lead has brought up from the bottom of the deep sea, probably did not live or die there. They would have had no light there, and their frail little textures would have been subjected in their growth to a pressure upon them of a column of water 12,000 feet high, equal to the weight of 400 atmospheres. They probably lived and died near the surface, where they could feel the genial influences of both light and heat, and were buried in the lichen caves below, after death.

Brooke's lead and the microscope, therefore, it would seem, are about to teach us to regard the ocean in a new light. Its bosom, which teems with animal life, its face upon which time writes no wrinkles, makes no impression, are, it would now seem, obedient to the great law of change as is any department whatever, either of the animal or the vegetable kingdom. It is now suggested that, henceforward, we should view the surface of the sea as a nursery, teeming with nascent organism; its depths, as the cemetery for families of living creatures that outnumber the sands on the sea-shore for multitude.

Where there is a nursery, hard by there will be found also a graveyard—such is the condition of the animal world. But it never occurred to us before, to consider the surface of the sea one wide nursery, its every ripple as a cradle, and its bottom as one vast burial place.

On those parts of the solid portions of the earth's crust which are at the bottom of the atmosphere, various agents are at work, levelling both upward and downward. Heat and cold, rain and sunshine, the winds and the streams, all assisted by the forces of gravitation, are unceasingly washing away the high places; and as perpetually filling up the low.

But in contemplating the levelling agencies that are at work upon the solid portions of the crust of our planet which are at the bottom of the sea, we had come, almost, to the conclusion that these levelling agents are powerless there.

In the deep sea there are no abrading processes at work; neither frosts nor rains are felt there; and the force of gravitation is so paralyzed down there, that it cannot use half its power, as on the dry land, in tearing the overhanging rock from the precipice and casting it down in the valley below.

When, therefore, I was treating of the basin of the Atlantic on another occasion, the imagination was disposed to regard the waters of the sea as a vast cushion placed between the air and the bottom of the ocean to protect and defend it from these abrading agencies of the atmosphere.

The geological clock may, thought I, strike new periods; its hands may point to era after era; but so long as the ocean remains in its basin, so long as its bottom is covered with blue water, so long must the deep furrows and strong contrasts in the solid crust below, stand out ruggedly and boldly rugged. Nothing can fill up the hollows there; no agent now at work, that we know of, can descend into its depths and level off the floors of the sea.

But it now seems that we forget these oceans of animalculæ, that make the sea sparkle and glow with life. They are secreting from its surface solid matter for the very purpose of filling up those cavities below.

Those little marine insects are building their habitations at the surface, and when they die, their remains, in vast multitudes sink down, and settle upon the bottom. They are the atoms out of which mountains are formed—plains spread out. Our marl beds, the clay in our river bottoms, large portions of many of the great basins of the earth, are composed of the remains of just such little creatures as these, which the ingenuity of Brooke, and the industry of Berryman, have enabled us to fish up from the depth of more than two miles below the sea level.

These foraminifera, therefore, when living, may have been preparing the ingredients for the fruitful soil of a land that some earthquake or upheaval, in ages far away in the future may be sent to cast up from the bottom of the sea.

The study of these " sunless treasures," recovered with so much ingenuity from the rich bottom of the sea, suggests new views concerning the physical economy of the ocean.

I have endeavored to show how sea-shells and marine insects may, by reason of the offices which they perform, be regarded as compensations in that exquisite system of physical machinery by which the harmonies of nature are preserved.

The treasures of the lead, and revelations of the microscope, present the insects of the sea in a new light. We behold them now, serving not only as compensations by which the motions of

the water in its channels of circulation are regulated, but also acting as checks and balances, by which the equipoise between the solid and the fluid matter of the earth is preserved.

Should it be established that these microscopic creatures live at the surface, and are only buried at the bottom of the sea, we may then view them as conservators of the ocean; for, in the offices which they perform, they assist to preserve its status by maintaining the purity of its waters.

It is admitted that the salts of the sea come from the land, and that they consist of the soluble matter which the rains wash out from the fields, and which the rivers bring down to the sea.

The waters of the Mississippi and the Amazon, with all the streams and rivers of the world, both great and small, hold in solution large quantities of lime, soda, iron and other matter. They discharge annually into the sea an amount of this soluble matter, which, if precipitated and collected into one mass, would no doubt surprise and astonish the boldest speculator with its magnitude.

This soluble matter cannot be evaporated. Once in the ocean, there it must remain; and as the rivers are continually pouring in fresh supplies, the sea, it has been argued, must continue to become more and more salt.

Now the rivers convey to the sea this solid matter mixed with fresh water, which, being lighter than that of the ocean, remains for a considerable time at or near the surface. Here, the microscopic organisms of the deep sea lead are continually at work, secreting this same lime, and soda, &c., and extracting from the sea water all this solid matter as fast as the rivers bring it down and empty into the sea.

Thus, we haul up from the deep sea, specimens of dead animals, and recognize in them the remains of creatures, which, though invisible to the naked eye, have nevertheless assigned to them a most important office in the physical economy of the universe, viz: that of regulating the saltness of the sea.

This suggests many contemplations. Among them, one in which the ocean is presented as a vast chemical bath, in which the solid parts of the earth are washed, filtered, aud precipitated again on solid matter, but in a new form, and with fresh properties.

Doubtless, it is only a readaptation, though it may be in an improved form, of old, and perhaps effete matter, to the uses and well-being of man.

These are speculations merely; they may be fancies without foundations, but idle they are not, I am sure; for when we come to consider the agents by which the physical economy of this, our earth, is regulated, by which this or that result is brought about and accomplished in this beautiful system of terrestrial arrangements—we are utterly amazed at the offices which have been performed, the work which has been done by the animalculæ.

But whence come the little calcareous shells, which Brooke's lead has brought up in proof of its sounding, from the depth of two miles and a quarter? Did they live in the surface waters immediately above? or in their *habitat* in some remote part of the sea, whence at their death, the currents were sent forth as pall bearers, with the command to deposit their remains where the plummet found them?

In this view, these little organisms become doubly interesting. When dead the descent of the shell to its final resting place would not it may be supposed, be very rapid. It would partake of the motion of the sea-water in which it lived and died, and probably be carried along with it in its channels of circulation for many a long mile.

The microscope, under the eye of Ehrenberg, has enabled us to put tallies on the wings of the wind, to learn of them somewhat concerning "its circuits."

Now, may not these shells which were so fine and impalpable that the officers of the Dolphin took them to be a mass of unctious clay—may not, I say, these, with other specimens of soundings yet to be collected, be all converted by the microscope into tallies for the waters of the different parts of the sea, by which the channels, through which the circulation of the ocean is carried on, are to be revealed?

Suppose that the dwelling places of the little shells which compose this specimen from that part of the ocean be ascertained, by referring to living types, to be the Gulf of Mexico—and of that from this part of the ocean, the regions about Cape Horn—of another, the Arctic Ocean, &c. The *habitat* and burial place, in every instance, we will suppose, are far removed from each other. By what agency, except through that of currents, can we suppose them to come from the place of their birth, and to be transported to that of their burial?

It is in vain to attempt to answer the *cui bono* in all the bearings of facts like these. Suffice it to say they are physical facts; and in them, therefore, there is knowledge. They are facts which concern our planet, and touch the well-being or the rightly knowing of its inhabitants; and, therefore, renewed attention to this subject of deep sea soundings and the specimens of the bottom that may be brought up, cannot fail to be regarded with increasing interest.

There is something peculiarly attractive and interesting about the mysteries of the sea. There is a longing desire to know more of them.

Man can never see, he can only touch the bottom of the deep sea, and then only with the plummet. Whatever it brings up thence, is to the philosopher, matter of powerful interest; for by such information alone as he may gather from a most careful examination of such matter, the amount of human knowledge concerning nearly all that portion of our planet which is covered by the sea, must depend.

Every specimen of bottom from the deep sea is therefore to be regarded as a valuable contribution to the sources of human knowledge. And it is, in the judgment of right-minded men, a glorious privilege to have an opportunity of increasing the stock of human knowledge.

As it regards the subject before us, the officers of the American Navy are peculiarly favored.

They especially have the means and implements for sounding the ocean in its greatest depths, for collecting specimens from its bottom, as well as from its surface, and for trying its currents and its temperatures both at and below the surface.

The means of doing this are not only placed at their disposal by an enlightened government, but it is by that government made their duty, as I am sure it will be their pleasure, to use them.

I hope soon to have this interesting department of the physical geography of the sea enriched, not only by specimens of bottom and soundings, but with various other materials and data collected by our ships afloat in the Indian and Pacific oceans, the China seas, and elsewhere.

I cannot find terms too strong to express my ideas as to the sublime spectacle which the world is about to afford, touching this united effort to investigate the laws which control the winds and currents of the sea.

The observations that are to be made for this purpose, are to be placed beyond the casualties of war. When Capt. Cook was on his celebrated voyage of discovery, war broke out between France and England, and the French Government was asked, for the sake of his mission, not to molest him.

The reply of the French King was, " I war not against science"; and orders were given to officers of the French Navy that if any of them should fall in with Capt. Cook, to recollect that he was the enemy of no man, but the friend of the human family; and they were commanded to treat him as such.

The Brussels Conference has recommended a like immunity for the observations that are to be made under this general system of cooperation, of vessels of all nations at sea, and the government of the United States has endorsed it.

By such a corps of observers, for in addition to our own, the marine, both commercial and naval, of Holland, Prussia, Denmark, and Sweden, of Belgium, Bremen, Hamburg, Russia, Portugal and Spain, of Chili, Brazil, and Great Britain, are enlisted, and are actually at work.

By the labors of such multitudes all catechizing nature to the same point, and questioning the winds and the waves for their secrets, we may expect many an answer that will have a bearing for man's good, as to which we little dream.

I may be pardoned for illustrating this position by an incident of recent occurrence.

The national heart is yet grieving for the terrible calamity and dreadful loss of life which has recently occurred on board the steamer San Francisco, as she was bound hence to California, with seven or eight hundred souls on board.

She was reported to have been seen on the 25th and 26th of December, in a completely disabled condition. There was anxiety in the public mind, and a desire and readiness to send relief to those gallant men. But which way or where to send vessels and relief, who could tell?

I was called on. After consulting that chart* on the wall, on which the temperature of the surface water of the ocean is shown for each month, I was surprised to find that the limits of the Gulf

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* Maury's Wind and Current Charts—Thermal Chart, North Atlantic series.

Stream for the month of January were what that chart shows them to be.

I discovered from this examination, that the San Francisco when seen on the 25th and 26th of December, instead of being on the southern edge of the Gulf Stream, as was generally supposed, and as the common charts of navigation would seem to indicate, was actually north of the middle.

The diagram there is taken from a chart, on which, for the information of the Navy department, I described the position of the Gulf Stream for January, and drew lines to show the direction in which the wreck had probably drifted, and the place where she would be most likely to be found.

Happily before any of the vessels sent in search of her had sailed, the Kilby, the Three Bells, and the Antarctic, had fallen in with, and relieved her. But this was not known at the time, and the instructions which, by request of the Secretary of the Treasury, I gave to the Revenue Cutter from New London, and which instructions were derived entirely from that chart, directed the vessel to pass so near the place where the San Francisco went down, that had the cutter been in time, she would have been in sight of the steamer when she went down.

There has been recently commenced at the Observatory, a chart which it may be worth while to mention, as it bears upon the subject before us. It is what may be called a topographical chart of the sea. The object of it is, by means of the materials which are afforded by the large corps of observers, who are coöperating with me in researches concerning the phenomena of the sea, to show those parts of the ocean where icebergs are seen, where snow falls, where water-spouts rise, where drift wood is found, where sea-weed, flying-fish, &c., are seen.

ARTICLE II.

BOUNDARY BETWEEN THE UNITED STATES AND MEXICO.

BY WM. H. EMORY.

Determination of the Line forming the Boundary between the United States and the Republic of Mexico, from the Initial Point on the Pacific Ocean, to the point where the "Gila River empties into the Colorado." Prepared for the American Geographical Society, by Wm. H. Emory.

I. The portion of the Boundary discussed consists of a straight line from a point on the Pacific Ocean, one marine league south of the port of San Diego, to the junction of the Gila and Colorado. The most obvious way of determining the direction of this line was to connect the two points by triangulation, and in this way ascertain their relative positions on the face of the earth, and compute the azimuth of the line joining them. But the character of the intervening country made it impossible to pursue this mode of operating, when the time and means at the disposal of the joint Commission were considered. Triangulation is the surest, but it is the slowest and most expensive method of surveying, even in old settled countries where the stations to be selected are easily accessible in wagons. In the country under consideration, obstacles presented themselves almost insurmountable. The whole distance, about 148 miles, may be divided into two nearly equal parts, differing in character, but both equally unfavorable to Geodetic operations. The first rising in steps from the sea, and covered with spinose vegetation, attains in abrupt ascents, the height of five or six thousand feet, in the short space of thirty miles. From this point for about thirty miles, the country is occupied by a succession

of parallel ridges, striking the Boundary nearly at right angles, and separated by deep and sometimes impassable chasms. It then falls abruptly to near the level of the sea. The remainder of the line stretches across the desert of shifting sand, at the head of the Gulf of California, destitute for the most part of both water and vegetation.

II. The following is the order in which are arranged the subjects embraced in the determination of the line.

1. The Longitude of Camp Riley near the Initial Point.
2. The Longitude of Camp near the Junction of the Gila and Colorado.
3. The Latitude of Camp near the Junction of the Gila and Colorado.
4. The Latitude of Camp Riley near the Initial Point.
5. Transfer of the Latitude and Longitude of Camp Riley by triangulation to the Initial Point.
6. Transfer of the Latitude and Longitude of Camp near the Junction of the Gila and Colorado by direct measurement.
7. Computation of the Azimuth of the line.
8. Result.

Numbers 1, 4, 5, 7, and 8, are by myself. Nos. 2 and 3 are by Lieut. Whipple.

The tracing of the line on the ground was partly by myself and Lieut. Whipple, but chiefly by Capt. E. L. F. Hardcastle, corps Topographical Engineers.

The computation of the Azimuth of the line was made in the field. In this computation the earth was supposed to be a spheroid of revolution of the following dimensions, which are those determined by Bessel from all the measurements up to that time, 1849, and the elements given by him were converted into English measure by adopting Kater's value of the Metre.

Viz: 39,370 79; Logarithms 1.5951741293.

y
Eqatorial radius = 6,974532.339
Polar radius = 6,951218.059

I am indebted to Professor Airy for the observations at Greenwich, for 1849, and for the recomputation of the Longitude and the application of the correction due to the corresponding observations on ☾ and ☾ culminating stars, I am indebted to the assistance of Professor J. S. Hubbard, of the National Observatory.

III. Longitude of Camp Riley and the Junction of the Gila and Colorado rivers.

The observations with the transit instrument have been reduced in the following manner:

The equatorial intervals of the transit wires having been determined as accurately as possible, the imperfect transits were corrected by applying to the mean of the observed wires, the mean of their equatorial intervals multiplied by the secant of the stars' declination. For circumpolar stars each wire was reduced separately, and the mean of the results taken. In the case of the Moon, allowance was made for its motion by the method and tables of Bessel (Tabulæ Regiomontanæ pp. LII and 537).

Denoting by a the constant of correction for azimuth of the instrument, by b the constant for level, and by c that for collimation, and by d the stars right ascension, δ its Declination and z its zenith distance, and by t the chronometer time of its transit, and by Δt the correction of the chronometer at the time t, we have the known formula

$$\mathrm{a} = t + \Delta t + a \sin. z : \sec. \delta + b. \cos. z. \sec. \delta + c. \sec. \delta$$

If φ denote the latitude of the observer, and if

$$m = b. \cos \varphi + a. \sin \varphi$$

$$n = b. \sin. \varphi - a \cos. \varphi$$

the expression above becomes

$$\mathrm{a} = t + \Delta t + m + n. \tan. \delta + c. \sec \delta$$

Or

$$\mathrm{a} = t + \Delta t + m + (n + c) \tan \delta + c. (\sec \delta - \tan \delta$$

which last form has been employed in the reductions. In the observations at Camp Riley $c = o$ for nearly the whole series, and is small enough at all times to have no effect in the last term of the formula; in the other series, one or two cases occur where it has been necessary to take this last term into account. Where as in

the present case only the Right Ascension of the body is wanted, the quantities Δt and m being constant for the evening may be combined together, and then the last term of one equation, always small and vanishing at no great distance from the equator, being introduced when necessary, and the requisite correction for the chronometer rate being applied, it is evident that but two equations are necessary for the determinaton of the unknown quantities. One is generally furnished by a circumpolar star, the other by the mean of the equations, corresponding to all the stars near the Moon's path, in order the more completely to remove all chance of constant error from the desired result. The equations being solved, furnish the quantities given below, and which have been applied to the observations.

The first column contains the date, the second the name of the object observed. The third shows the position of the instrument, (Lamp East or West.) Next follows columns 4, 5, 6, 7, 8, 9, 10, the seconds of observed transit, and column 11 the mean of the transit over as many wires as have been observed, column 12 contains the correction to be applied to this mean for an imperfect transit; column 13 the correction for instrumental error, or the quantity $(n + c) \tan \delta + c. (\sec \delta - \tan \delta)$ the last term of which is generally $= o$: and column 14 gives the correction of chronometer, and the constant term of instrumental correction, or the quantity $\Delta t + m$. In cases where a mean time chronometer has been used, this column includes also the reduction of mean to sidereal time, the quantities in all the preceding columns being in mean time. In column 15 is given the sum of the quantities, in columns 11, 12, 13, and 14, are the observed Right Ascension of the object, and the last column, shows the tubular Right ascension taken in the order of preference from the Nautical Almanac, the Greenwich Twelve-Year Catalogue, or the Catalogue of the British Association.

The next step was to deduce the required corrections of the assumed longitude of the place, by comparing the observed AR of the Moon with that corresponding to the assumed longitude already determined very approximately by computations in the field For this purpose the Tubular A R was interpolated from the Moon Culminating List of the Nautical Almanac, using fourth differences, and it was found that the assumed longitude corres-

ponded perfectly to the results from the uncorrected Tabular place of the Moon. But the extracts from the observations at Greenwich given below, show a correction of the latter to be necessary, and this being applied, the corresponding correction of the assumed longitude was determined and also applied.

NOTE. (The form in which the Bulletin of the Society is published being unsuited to the arrangement of the tables referred to in the preceding article, they are omitted, but will be furnished in the final report upon the Boundary Survey. They embrace many thousand figures, showing the elaborate observations from which the following results are obtained.)

IV.

From the "Greenwich Observations" for 1849, we obtain the following observed corrections of the Moon's bright limb.

Longitude of Camp Riley, by corresponding observations.

July 27	I.	—$0^s.51$	Sept. 22	I.	—$0^s.68$	July 27	$7^h\,48^m\,37^s.98$
" 28	I.	.55	" 25	I.	.15	" 28	23.51
" 29	I.	.48	" 26	I.	.22	" 29	7.45
" 30	I.	.48	" 30	I.	.56	" 30	37.60
" 31	I.	.26	Octr. 2	II.	.67	" 31	39.29
Augt. 1	I.	.44	" 4	II.	.65	Augt. 3	31.57
" 3	I.	.18	" 5	II.	.47	" 29	39.97
" 3	II.	.73	" 8	II.	.32	Sept. 5	6.99
" 4	II.	.38	" 9	II.	.67	" 30	18.27
" 6	II.	.38				Octr. 28	24.48
" 8	II.	.54	Octr. 28	I.	.60	" 29	15.13
" 11	II.	.62	" 29	I.	.67	Novr. 1	13.41
			" 31	II.	.73	" 5	25.37
Augt. 23	I.	1.22	Novr. 1	II.	.50		
" 24	I.	.68	" 4	II.	.60	Mean	$7^h\,48^m\,24^s.70$
" 29	I.	.46	" 5	II.	.74		
" 31	I.	.47					
Sept. 5	II.	.22					
" 8	II.	.41					
" 9	II.	.51					

Prob. error of result $= \pm 2^s.32$

" " single obs. $= \pm 8^s.05$

The following have been adopted as corrections for the respective lunations.

July	27	to	Augst.	11	-	0.47
Augst.	23	"	Sept.	9	-	0.54
Sept.	22	"	Octr.	9	.	0.43
Octr.	28	"	Nov.	5	-	0.63

Applying these corrections to the computed AR of the Moon's limb for each date of observations, and comparing with the observed AR we obtain:

July	27	$7^h\ 48^m\ 36^s.81$	
"	28	20.90	
"	29	6.88	
"	30	37.32	
"	31	45.03	
Augst.	2	29.28	
"	3	39.60	
"	26	23.07	
"	27	36.91	Mean $7^h\ 48^m\ 25^s.98$
"	28	21.77	
"	29	41.89	Prob. error of single obs. $= \pm\ 7^s.21$
Sept.	3	9.77	
"	4	18.54	" " " result $= \pm\ 1.44$
"	5	15.12	
"	24	41.90	
"	27	34.61	
"	28	22.98	
"	29	21.85	
"	30	17.78	
Octr.	23	34.80	
"	25	22.50	
"	28	25.02	
"	29	14.09	
Nov.	1	16.17	
"	2	18.00	
"	5	22.75	

The Longitude of Camp Riley, computed in the field, from the predicted place of the Moon in the Greenwich ephemeris for 1849 $= 7^h\ 48^m\ 13^s.1$

Difference, $=$ **12.88**

The following are the results from the observations at the observatory, near the Junction of the Gila and Colorado.

Octr.	3	$7^h 38^m 47.04$
"	4	37.61
"	5	33.82
"	6	27 69
"	7	33.70
"	23	5.84
"	24	31.95
"	25	37 40.18
"	26	38 31.64
"	27	26.66
"	28	23.62
"	29	16.17
"	30	21.74
"	31	9.14
Nov.	1	30.58
"	2	32.59
"	3	29.66
"	4	28.44
"	5	30.30
"	6	22.42
"	20	32.43
"	22	27.53
"	23	23.44
"	24	45.40
"	25	14.99
"	27	25.72
"	29	25.25

Mean $7^h 38^m 25^s.75$

Prob. error of single obs. $= \pm 8^s.71$

" " " mean result $= \pm 1^s.71$

The Longitude of the same computed in the field from the Greenwich ephemeris for 1849, $= 7^h 38^m 12^s.53$

Difference, $=$ $13^s.2$

The Latitude of Camp Riley determined with a Zenith Telescope of 46 inches focal length by observations on eighty-two different stars is - N. 32° 35′ 43″.53

The Latitude of observatory near the Junction of the Gila and Colorado Rivers, - - - N. 32° 43′ 42″54

V. Triangulation by which the Observed Latitude and Longitude of Camp Riley was transferred to the Initial Point of the Boundary on the Pacific.

Measurement of the Base Line.

(Unit of Measure a Mêtre graduated by Gambey of Paris.)

1st measurement with rods made of seasoned red wood, - - - - - - -	4536.7895 mêtres.
2d measurement with steel wires belonging to Señor Salazar, Surveyor of the Mexican Commission. - - - - - - -	4536.60 "
	2)3895
Result adopted, - - - - -	4536.6947

Solution of the Triangle.

Stations.	No. of Obs.	Observed Angles.	Distribt'n and error	Spher excess	Plane Angles and Distances	Logarithms
E. Base,	24	37°25′57″.5	+ 0 033	00	37°25′57″.53	9 7837811
W. Base,	16	107°34′01″.2	+ 0.033	00	107°34′01″ 23	
Int. Pt.,	24	35°00′01″.2	+ 0 033	00	35°00′01″.23	9.7585949
			+ 0.1			
East Base to West Base, -					4536.39	3 6567391
East Base to Initial Point, - -					7540 59	3 8774051
West Base to Initial Point, -					4807.56	3.6819252

Calculation of the Geographical Position of the Initial Point.

Azimuth of the line from East Base to Initial Point determined by measurement of Angle made with Meridian of the Observatory, and also by various measurements of the Elongations of Polaris. Counting from the South towards the West, 24° 31′ 31″.

Latitude of East Base situated precisely in the Meridian of Observatory at Camp Riley and determined by direct measurement to be south of it 1″.2 North Latitude 32° 35′ 42″33.

East Base to Initial Point = K = 7540.59 mêtres, H = 32° 35′ 42″.33, P = 117° 03′16″.5, Z = 24° 31′31″

Log. K = 3.877405
Log. $\frac{1}{N \sin.1''}$ 8 5093882

Log u'' 12.3868933

1st term H = 32° 35′ 42″.33
2d term H = 342.76
3d term H =

Lat. Int'l Pt. = 32° 31′ 59″.59

(2d term H) log. $(1 + E^2 \cos.^2 H) = 0\ 0020139$
Log. u - - = 2 3868933
Log. cos. Z - - = 9.9589355

Log. u' = 2.3868933
Log. sin. Z = 9.6181471

12.0050504
Log. Cos. H = 9.9258689

2.0791815 = log. 120″

Log. 2d term = 2 3478427
2d term = 222″.76

3rd term H. log. u'' = 2.3868933
Log. sin. Z = 9.6181471

2.0050404
2

P = 117° 03′16″.5
$\frac{u' \sin z}{\cos. H}$ = 2 00

Long. Int. P. = 117°05′16″.5

Log. $(u' \sin. Z)^2$. = 4.0100808
Log. $(1 + e^2 \cos.^2 H$ = 0.0020139
Log. $\frac{\sin.1''}{2}$ = 4.3845449
Log. tang. H = 9.8057664

8.2024060

Calculation of the Geographical Position of Station "West Base."

Measured Azimuth of Base Line = Z = 61° 57′28″.5. Base Line = K = 4536.69 mètres.

1st term H = 32° 35′42″.33
2d term H = 1′09″.23
3d term H = 0′00″.00

H. or W. Base = 32° 34′33″.10

Log. K = 3.6567391
Log. $\frac{1}{N \sin. 1''}$ = 8 5093882
Log. u'' = 2 1661273
Log. $(1+e^2\cos.^2 H)$ = 0.0020139
Log. cos. Z = 9.6722077

1 8403489
2d term = 69″.23

$$
\begin{array}{rl}
\text{Log. } u'' = & 2.1661273 \\
\text{Log. sin. } Z = & 9.9457651 \\
\hline
 & 2.1118924 \\
\text{Log. cos. } H = & 9.9256623 \\
\hline
 & 2.1862301 \\
2^{d} \text{ term } P = & 153.54 = 2'33''.54 \\
 & \\
P = & 117^\circ 03' 16''.5 \\
2^{d} \text{ term} = & 2'33''.54 \\
\hline
\text{P. or long. of West Base,} & 117^\circ 05' 50''.04
\end{array}
$$

$$
\begin{array}{rl}
 & \text{3d term.} \\
\text{Log. } u' = & 2.1661273 \\
\text{Log. sin. } Z = & 9.9457651 \\
\hline
 & 2.1118924 \\
 & 2 \\
\hline
\text{Log } (u' \text{ sin. } Z)^2 = & 4.2237848 \\
\text{Log. } (1+e^2 \text{ cos.}^2 H) = & 0.0020139 \\
\text{Log. } \frac{\text{sin. } 1}{2} = & 4.3845449 \\
= & 9.8057664 \\
\hline
 & 8.4141100
\end{array}
$$

Calculation of the Azimuth of the Line from Initial Point of the Boundary to East Base.

$$
\text{Log. } K = 3.8774050 = 7540.59 \quad Z = 180 + Z - \frac{u \text{ sin.} Z}{\text{cos. } L'} \text{ sin.} \tfrac{1}{2}(L+L')
$$

$$
\begin{array}{rl}
\frac{1}{N \text{ sin. } 1''} = & 8.5093881 \\
\text{Sin. } Z = & 8.6181471 \\
\hline
 & 2.0049402 \\
\text{Cos. } L = & 9.9258689 \\
\hline
 & 2.0790713 \\
\text{Sin. } \frac{L+L'}{2} = & 9.7309790 \\
\hline
64''.57 = & 1.8100503
\end{array}
\qquad
\begin{array}{rl}
\text{Measured } Z = & 24^\circ 31' 16'' \\
 & +\ 15 \text{ err. in merid} \\
\hline
 & 24^\circ 31' 31'' \\
 & 180 \\
\hline
 & 204^\circ 31' 31'' \\
 & 1' 04''.5 \\
\hline
Z = & 204^\circ 30' 25''.5
\end{array}
$$

VI. In the computation for the direction of the line the Longitude of the Initial Point and the Longitude of the Junction of the Gila and Colorado are taken as determined in the field by the observations compared with the Moon's place, as given in the Nautical Almanac (Greenwich). On arriving at Washington, I obtained from Prof. Airy his corresponding observations, made at Greenwich, and it will be seen that a change has been made in the absolute Longitude of both places, but fortunately no material change is discoverable in the relative Longitude of the two places. Now an inspection of the formula used will show that the *differ-*

ence in Longitude is the element used in determining the Azimuth of the line connecting the two points. Hence the change deduced from comparison with the corresponding Greenwich observations does not affect this result.

The preceding pages show the process by which the Latitude and Longitude of Camp Riley was transferred to the Initial Point of the Boundary on the Pacific.

A word upon the subject of the transfer to the "Junction" of the Latitude and Longitude of the Observatory near that point; the distance between them was so small that the transfer may be considered as having been accomplished by direct measurement.

Whipple's report to me, Nov. 30th, 1849, gives,

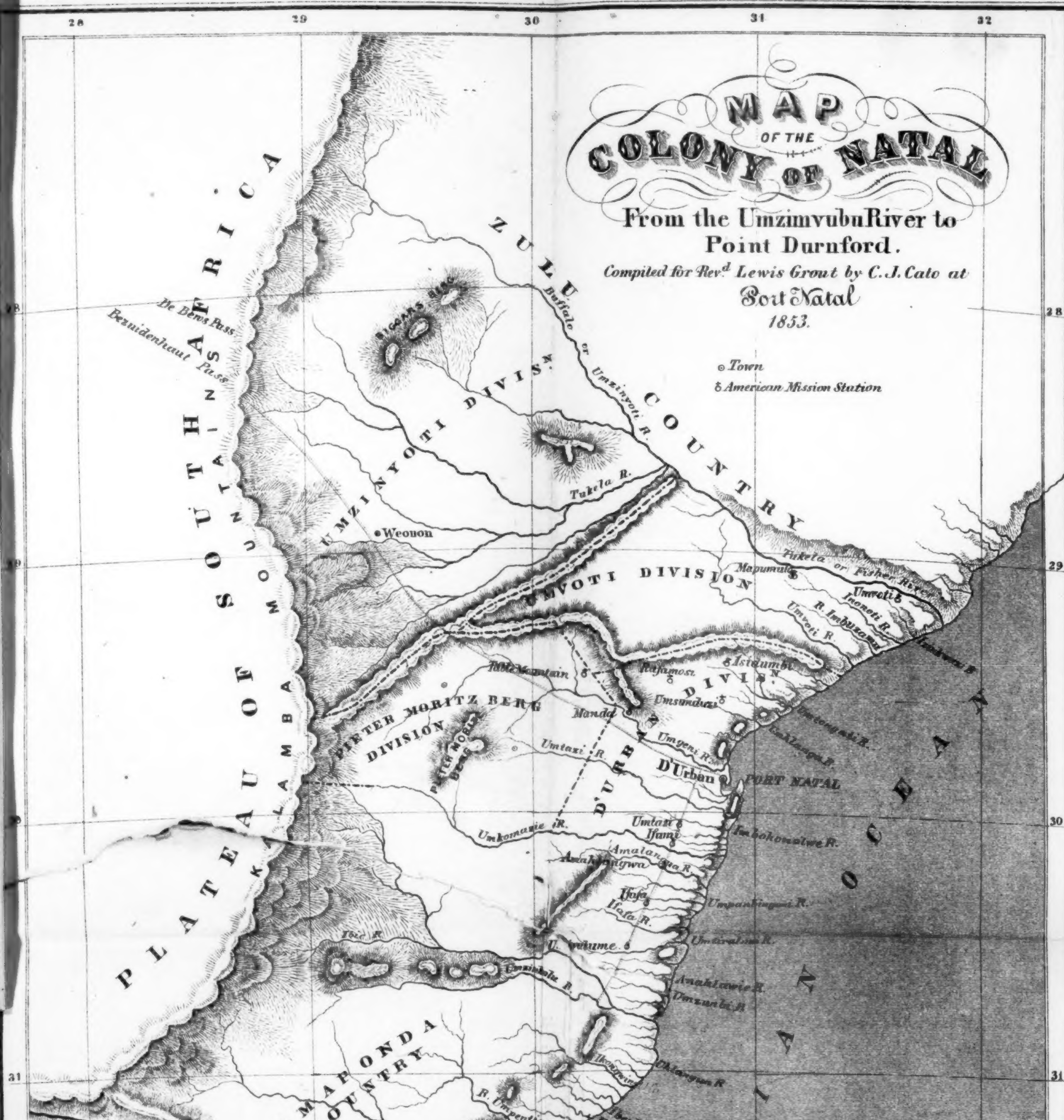
The Longitude of Observatory $7^h 38^m 12^s.53$ in arc.	114° 33′ 07″.95
" " Junction, - - - -	114° 32′ 51″.61
Difference, - - - -	00 00 16″.34
Latitude of Observatory (see Report of Nov. 24th,)	32° 43′ 43″.96
" " Junction, - - - - - -	32° 43′ 32″.3
Difference, - - - - - -	00 00 11″.66

These corresponding with my computations founded on the same data, were adopted, but it must be observed to prevent future misunderstanding, that it was impracticable to measure the Azimuth from the Junction of the two Rivers (then under water) and a point, B. (see sketch) was selected in the Azimuth produced, ascertained by direct measurement to be 73.5 feet south and 1070 feet west of the Junction, and here the Monument was placed and the Azimuth measured from it. The Geographical position of this monument is consequently,

In North Latitude, - - -	32°, 43′. 31″.6
Uncorrected Longitude, - - -	104°. 33′.04″.3

VII. The computation of the Azimuth and Length of the line of boundary extending from the Initial Point on the Pacific Coast, near San Diego, to the junction of the Gila and Colorado was based on the following assumption:

Latitude of Initial Point on the Pacific = -	32° 31′ 59″.63
Latitude of junction of Gila and Colorado = -	32° 43′ 32″.3
Difference of Longitude = - -	2° 32′ 24″.9


MAP OF THE COLONY OF NATAL
From the Umzimvubu River to Point Durnford.
Compiled for Revd Lewis Grout by C. J. Cato at Port Natal
1853.
Town
American Mission Station
ZULU COUNTRY
PLATEAU OF SOUTH AFRICA
KAHLAMBA MOUNTAINS
UMZINYOTI DIVISN
UMVOTI DIVISION
PIETER MORITZ BERG DIVISION
D'URBAN DIVISN
AMAPONDA COUNTRY
FUKUS TERRITORY
INDIAN OCEAN
PORT NATAL
D'Urban
Tukela R.
Weenen
Umzimbubu or St. Johns River
De Beers Pass
Bezuidenhout Pass
Buffalo or Umzinyoti R.
Tukela or Fisher River
Umgeni R.
Umlazi R.
Umkomazi R.

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ARTICLE III.

A DESCRIPTION OF NATAL.

BY REV. H. A. WILDER.

THE district of NATAL, in South-eastern Africa, is bounded on the North and North-east by the Utugela and Umzimgati rivers; on the South-east by the Indian ocean; on the South and South-west by the Umzimkulu river, and on the West by the Kwahlamba or Drakensberg mountains. On the North and North-east lie the possessions of the Zulu Chief Umpandi;—on the South-west is the territory of Faku, the chief of the Amampondo, a large and powerful tribe of Kafirs, on peaceable terms with the English; on the West lies the Soveuignty and the county of Mosheshe, a renowned Chief of the Basutas, and to the North-west are the Amaswasi tribes.

Natal has a coast on the Indian Ocean of about two hundred miles, and it stretches inland from one hundred to two hundred miles. Its area is some twelve or fifteen millions of acres. It is mostly comprehended between twenty-eight and thirty-one degrees of South latitude, and between twenty-eight degrees and thirty minutes and thirty-one degrees and thirty-two minutes of East longitude.

The missionaries of the A. B. C. F. M. are chiefly located near the coast extending from the Umzimkulu to the Utugela rivers, and it is to the portion of the district occupied by them that this paper chiefly relates.

For the purpose of description the coast portion of Natal may

be conveniently divided into two sections—the one commencing at the beach and extending inland from five to fifteen miles, and the second reaching from ten to twenty miles beyond the first.

In the first division, or that lying next the sea, the land rises gently as it recedes from the shore, and is everywhere strongly undulated. From one end of the colony to the other along the coast, is an almost unbroken succession of similar hills, and vales, and streams, rising and falling and flowing in endless monotony.

The traveler fords a rivulet, ascends a hill, descends into a narrow valley, crosses a brook, ascends a hill;—and this is the whole variety of an ordinary day's journey. From any change in the general appearance of the country, or of his immediate locality, he would not know but he was at night in the same place from which he set out in the morning. Of course it is not a difficult nor unfrequent occurrence to lose one's way in such a country. If he beholds ahead of him, as he may, in the vicinity of Port Natal Bay, a level plain a few miles long, he hails with joy this interruption in the fatiguing monotony of grass covered hills and valleys.

However interesting at first sight this may be, yet who would not tire of beholding forever the congealed, motionless waves of the ocean.

The section next the beach is for the most part destitute of trees, except along the courses of some of the streams and in the kloofs.

Throughout the whole extent of the coast, however, with only here and there an exception, extends a dense jungle, varying in breadth from half-a-dozen rods to two or three miles. In this jungle which it is almost impossible for man to penetrate, except as he cuts a road before him, are found some good sized trees, but for the most part these are crooked, gnarled and stunted. But little is found fit for house building, though considerable quantities, on account of its hardness, durability and *crookedness*, is well adapted to the purposes of the ship builder, and much of it is also beautiful and valuable for the manufacture of wagons and furniture. At the head of Natal Bay, and near the mouth of the Umkomazi river, the red mangrove abounds, the long straight stems of which are valuable for house building.

The beach is generally low and sandy, but not unfrequently spurs of mountains are sent down to the sea, and bold headlands

advance into the waves. Everywhere at low tide rocky strata are laid bare, and many sharp pinnacles of rocks project from the water at considerable distances from the shore. Of course such a coast exposed as it is to an open sea, renders the approach of vessels with safety impossible. (Last year the "Hector," a large vessel was driven on the rocks near the Umtwalume river, and though she was within a half dozen rods of the dry land when she went to pieces, seven of her crew were lost. Another vessel a few weeks after ran on the rocks near the Umzimkulu, and many of the crew perished; though at low water, the place where she stuck fast is bare.) Not far from Ifumi missionary station, about three miles out at sea are rocks which rise to within five or six feet of the surface at low water. There also are three similar rocks about the same distance from the shore, opposite Amahlongwa, in latitude south about thirty degrees seventeen minutes.

During a great portion of the year the mouths of all, except the largest rivers, are blocked up by embankments of sand thrown up by the waves. Through these, all the water which enters the sea must percolate. The waters of the rivers thus obstructed set back, forming extensive lagoons, which are the favorite haunts of crocodiles, and hippopotami and serpents.

There are no good harbors from Massals Bay to Delagoa, except Natal Bay, and that, though perfectly safe for vessels once moored in its quiet enclosure, will not, on account of the shallowness of its entrance, admit vessels of large tonnage. Just outside of it is a dangerous bar which sometimes renders the port inaccessible for many days in succession. Vessels in it are obliged to take advantage of a West or South-west wind in order to get out to sea, and with none but an East or North-east wind can vessels enter the harbor.

An ocean current flows along the coast towards the South-west at a velocity of from two to five miles per hour.

The coast division of Natal is so open and free from obstructions that the large African wagon can travel throughout the whole extent of it, without much labor being required to make roads What labor is required is chiefly at the fords of the rivers, which often wash away their old banks and seek new channels. Innumerable small grassy rounded hills, and small sloping plains and vales, elevated by every possible angle to the horizon, rising higher

and higher, as they go inland, fill up and characterize the division next the beach. At varying distances of from five to fifteen miles inland they are spread out into table lands, which are terminated by steep descents and rocky precipices. These form the natural boundary of the coast division. At frequent intervals these table lands are clift asunder by the rivers, leaving perpendicular walls on each side matched to each other, from one hundred to two thousand feet high. In the deep valleys succeeding the coast division, there are but few places of access for wagons. Innumerable hills, from fifty to a thousand feet high, rise from the bottom of these valleys. Often single hills are entirely isolated, and appear like some vast artificial mound, but more frequently they occur in continuous chains joined one to another by narrow ridges of land. So precipitous are the sides of these, that the rider is in frequent fear least a stumble of his horse will send him tumbling hundreds of feet into the ravines below, and he can hardly tell, should such misfortune occur, whether he would be thrown down to the right or to the left of the ridge. Besides these grassy oval hills, there are in these valleys many isolated table lands, bounded on all sides by perpendicular walls. Boulders of immense size are scattered both in the ravines and on the hills.

The appearance this valley presents to those approaching it from the coast, has been compared to an ocean, first stirred by winds and earthquakes from its lowest depths, and then suddenly congealed; but such a comparison is wholly inadequate to convey an idea of the mighty forces which have piled up these lofty hills, hurled from their original beds these wonderful boulders, and protruded from the depths of the earth these fragmentary table lands and mountains, or left them standing when all else was swept away.

It is observable that most of the rocks in the section of which we are writing are of a *primary* character.

The table lands are capped or covered to the depth of two or three hundred feet usually, but sometimes much deeper, with red sandstone, but underneath this are quartz, granite, sienite and trap rocks.

Near the station of Rev. J. Tyler, at Esidumbini, is a granite boulder, forty feet thick, one hundred and forty feet long and ninety-five feet broad. One end is elevated thirty-four feet from

the earth, and the other, the thickest end about ten feet. The whole mass rests on three granite rocks five or six feet in diameter at the base. These shoot up like pinnacles, and are split into many slivers, as if the great boulder had fallen from above upon them, and partly crushed them. Close beside this is a granite column fifteen feet in diameter, shooting up to a point ninety feet high, and the whole of these are on a side hill some two hundred feet above the adjacent ravine.

At the summits of many of the mountains in this great valley are flat grassy plains several acres in extent; others terminate in sharp peaks or rounded domes, or are sculptured into a thousand fantastic shapes. It requires but little imagination to see the spires and domes, the towers and battlements of some old *Titanic* empire, all weaker remains of which have been long since sunk into the earth or washed away by floods. Here lies prostrate a Cyclopean form; there is a huge sphinx half buried in ruins; there a gigantic lion crouches as if to spring upon his prey. To the very summits of these highest mountains are abundant traces of water having once extensively worn the rocks. It would seem that in some remote period the table lands which bound this valley were cleft asunder both longitudinally and crosswise, leaving isolated fragments in the midst, and that then the constant flowing of ocean currents heaped up the *moraines* in the lower parts of the valley.

Beyond these valleys and isolated mountains the land gradually, and sometimes abruptly, rises and spreads out in broad table lands slightly undulating, often deeply cut by ravines and rivers, and at a distance traversed by ranges of mountains. In this region trees are scarce, except on the sides of some of the mountains where large and excellent timber for planks and for building purposes is found. There are also occasionally near some of the rivers, large patches of the thorny mimosa, which reminds the stranger of extensive orchards at a distance.

To one having penetrated fifty miles or thereabouts from the coast, the distant peaks of the Kwalamba mountains are visible, rising five or six thousand feet above the sea level.

Natal abounds in streams of pure and perennial water. A traveler along the coast may count upwards of one hundred streams which have their mouths in the Indian Ocean within the limits of the colony, and the inland country is everywhere sparkling with

branches and branchlets innumerable, by which these main streams are fed. One can scarcely travel an hour in any direction within forty miles of the coast, without crossing one or more of these beautiful streams. The streams in this country vary greatly in size and length. Many which are honored with names are not above three or four miles long, and can be stepped across. The Umzimkulu and Utugela are two or three hundred yards wide, and two hundred miles long.

Only three of the Natal rivers have their sources as far back as the heights of the Kwalamba mountains. These are the Umkomazi, the Umzimkulu and the Utugela. Several of the second class rivers rise in spurs sent out from the principal chain of the Kwalamba mountains. Among these are the Umgeni, Umboti and Umlazi. The rivers having their sources from fifty to one hundred miles inland are very numerous, and would (to a people disposed to take advantage of them) afford abundant water power for driving machinery. Their passages through the first and second table lands are often picturesque and grand. Usually the highlands are split asunder, and on each side stand perpendicular walls of red sandstone on a foundation of basalt or granite, rising many hundred feet above the waters that chafe and roar at their base. These walls often seem matched to each other, as if some mighty force had rent them asunder.

The traveler riding over the table lands beholds before him, as far as the eye can reach, nothing but grassy plains, or blue mountains in the far distance, when suddenly the earth opens—he stands on the edge of a precipice—he hears the roar, and far, far below he beholds the sparkling waters of a river, to pass which, he must lead his stumbling horse down ravines, through dark jungles, and over beds of huge rocks, hurled down from the heights above, as if to retard the victorious march of the torrent to its ocean home.

Many of the rivers in Natal are larger at a distance of twenty or thirty miles from the coast than they are at their mouths.

Cascades and falls are frequent in the Umgeni, north of Pirtermazitzburg, about twenty-five miles from that town is a perpendicular fall of 276 feet over basaltic rock. In the dry season the quantity of water falling is not large, but when the river is swollen by rains this fall is an object of rare beauty and sublimity.

In the vicinity of Table Mountain, a small branch of the Umgeni,

called the Inceku Falls, leaps in one fall about six hundred feet. When the quantity of water is small, it all dissipates into mist before it reaches the bottom.

The rivers of Natal may be conveniently classed according to the different elevations at which they take their rise. The longest rise in the Kwalamba mountains—the second class in spurs or branches of the Kwalamba, which shoot out seaward; the third have their sources chiefly in the extensive table lands, thirty or forty miles from the coast. Such rivers are embraced in this class as the Utongate, the Umhlote, Floro, Umtwalume and Umzumbe. The rivers of the fourth class have their sources in the great valley above described, lying next beyond the coast division. Among these are Umhlanga, Umhlali, Umpambingoni, Amanzimtole, Izimpongondwe, Ifafa, Umzinto and Amahlongwa. The rivers of the fifth class rise in the table lands which slope off to the beach, and are from two to ten miles long.

None of the rivers of Natal are available for inland navigation. Most of them are for the greater part of the year closed up at their mouths by sand banks thrown up by the waves. Only the rivers of the first and second classes open into the sea at all seasons, but there are so many rocks at their entrances, that for even the smallest vessels to enter, would be extremely dangerous if not impossible. Could they be entered safely, the three largest rivers might be navigated by vessels of light draught, at high tide, for several miles.

Nearly all the streams of Natal are perennial. Running over beds of granite, quartz, and trap rocks, they are but slightly, if at all, impregnated with mineral substances. In the coast divisions, the channels of the rivers are usually so far below the bordering lands, that the water cannot be made available for irrigation.

The soil varies greatly in character and fertility in different sections. Near the coast there is a preponderance of sandy soils, but as the country recedes from the sea, loams and clayey soils prevail, greatly varying in color and richness. Scarcely any pure clay is found. It is all mixed with coarse sand and mica. In most parts of the Colony, small shining particles of yellow mica are abundantly distributed, and have more than once, by those who would "make haste to be rich," been mistaken for "Afric's *golden sands.*"

Much of the soil is strongly impregnated with iron, the ore of

which often protrudes, and in some localities it is found of a rich quality and in abundance. In the vicinity of the Kwalamba mountains, strongly magnetic iron ore or *loadstone* has been found.

The soil is not generally rich, though under proper culture, most parts of the country can be rendered moderately productive, and the flats, which border on the rivers, and are annually overflown, yield luxuriant harvests.

Portions of the land near the coast and in the Eastern part of the Colony will yield two and sometimes three crops yearly of Indian corn.

The native cultivation of the soil is very superficial. They never dig it up more than three or four inches deep; they never manure it, and they burn up all the vegetation, which if suffered to decay, would enrich the soil. Such treatment fails to develop the capabilities of the land, and under it their gardens soon wear out, and in consequence, they are often obliged to change to new ground. The hill sides, the low valleys, and the alluvial plains, are chosen by the natives for cultivation rather than the table lands.

The numerous hills and mountains render a large portion of Natal unfit for agricultural purposes. Much of that which is partially occupied by natives would make an Englishman the poorer for owning it, if he were obliged to pay taxes on it. It is inaccessible to wagons, unfit for the plough, and a few rods of fertile soil are as unfrequent as the oasis of Sahara.

The productions of the native gardens are Indian corn, amabell, (a grain in its kernel and growth somewhat resembling broom corn,) several varieties of pumpkins, squashes, gourds, calabashes and melons; the common and the sweet potatoe, and an edible root resembling the wild turnip (*arum*) "*idumbi*," beans, and a sort of millet called "*upoko.*" Oranges, lemons, limes, pine-apples, plantains, bananas, and papaws, flourish near the coast, and a little inland and towards the South-Western part of the country, apples, peaches, plums, pomegranates, quinces, and cherries are raised successfully. Cotton, sugar cane, rice, coffee, tobacco, arrow-root, mandiock, wheat, oats, and indeed almost all the productions of the temperate and torrid zones can be raised in the limits of Natal Colony.

The extensive table lands are admirably adapted to the pasturage of cattle, goats, and sheep. The whole country is burnt over once

or twice a year, not all at once, but in sections, so that the numerous herds and flocks may always have fresh grass. There is no need in the regions adjacent to the coast that provision be laid up for cattle during the winter, for there are always fields clothed in verdure, over which they may range.

No more exciting and charming sight is known in Africa than the burning of the extensive fields of luxuriant grass. The flames once kindled fly rapidly before the wind, and by their crackling and heat rouse up the birds of night from their hiding places—wolves and hyenas escape howling before the conflagration—bucks and antelopes startled, with rapid speed and graceful bounds hasten to escape the all-devouring fire. On winter evenings long lines of fire sweep over the plains, descend into the deep valleys, quench their thirst, and expire at some crystal brook—others gather around some lofty hill, slowly scale its steep sides, blaze a moment on its summit, and die. In two or three days after the fire has consumed every trace of vegetation, thousands of little leafless scarlet flowers, (of the order amæyliacæ,) spring up where the fire has passed, whose beauty is so resplendent, that they would seem to entice the watery treasures of the clouds to their feet. In two or three weeks after the fire, the earth is again spread with a carpet of the richest green.

The climate of Natal is delightful. Exempt alike from the extremes of heat and cold, it realizes as nearly as any land, the idea of "eternal spring." From May till September, but little rain usually falls, and during this period the atmosphere is cool, clear, and bracing, and the sunshine almost uninterrupted. During this period the thermometer at Dustan, the port town, ranges from fifty to eighty degrees, Fahr. During the years 1845, '46, '47, '48, '49, and '50, the thermometer ranged between 53° and 90° Fahr. in the shade. During that period the mean temperature was 76° Fahr.

Of course in a country so uneven and mountainous as Natal the temperature varies considerably in different localities, which have the same latitude, and fifty miles inland the extremes of heat and cold are very distant from each other. At Ifumi mission station, about five miles only from the sea, and in latitude about 30° 10′ South the thermometer had risen to 110° in the shade at noon, and the following night had sunk to 43°. In many low valleys not far from the coast, frost is common during the winter, and in latitude

30° 30′ there are almost constantly frosty nights during June and July. On the Kwalamba mountains and their numerous Eastern branches snows often fall, and not unfrequently in large quantities during the cold season.

From October to April rain frequently falls. Storms are common; during which immense quantities of electricity are discharged, and in a few hours the fall of rain is so great that all the rivers are made impassible. So rapid sometimes are the discharges of electricity, that the whole firmament constantly glows with flame, and the earth seems as if cast into the midst of a burning fiery furnace. Clouds laden with the subtle fluid rise in opposite parts of the sky, and while they approach each other through the clear blue heavens, the lightning assumes a thousand unexpected and terrible forms and motions. Fiery serpents from East to West leap together, grapple, twist around each other, and rush up the firmament;—arrows and javelins of fire cross each other in mid-heaven; meteors of various hues are shot down from the zenith;—now pours to earth a mighty cataract of, as it were, "blood mingled with fire,"—then back again to heaven spouts a flood of molten iron;—then rises from the edge of the distant horizon a sulphurous column—blue, yellow, red, violet, which, spreading into innumerable tree-like branches, as it ascends and crowns the clouds with wreaths of fire. Perhaps as the clouds meet and unite over head, there is for an instant a cessation of the battle of the elements; darkness and the stillness of universal death prevails. In an instant bursts forth a light above the brightness of the sun, immediately following which is a terrible roar and crash as if the universe were shattered to pieces. The solid earth trembles, and man and beast quake with fear. Athwart the whole heavens a vast chasm is rent, through whose glowing and blackened wall we catch glimpses of tenfold fiercer flames beyond; in a moment is another flash, and the whole brazen firmament seems shattered into millions of falling fragments, and above all louder and still louder soars and crashes the awful thunder.

Near the coast the more violent storms come from the South-West, and but seldom from the East. Life and property is frequently destroyed by electricity, and on many a bare cliff, and down the sides of the loftiest mountains, is visible "the way of the lightning of thunder."

The climate of Natal is one of the most healthy in the world. Neither foreigners nor natives are subject to any disease peculiar to the country, and many who have come here from Europe have been greatly benefitted in health. Some who were afflicted with bronchitis in England are almost free from it here, and those who in colder climes were attacked by consumption have had their lives lengthened in this Colony. Dysentery and some forms of fever are not unfrequent, but properly treated in season, are seldom or never fatal.

Among the natives, pulmonary diseases are somewhat common and fatal, but these are induced by their habits and excessive imprudence, rather than by any predisposing causes in the climate. Still there is reason to conclude that the sudden changes of temperature, and the cold raw winds which often blow even in the summer in some localities do induce disease of the lungs. Colds are common and severe, and attacks of rheumatism often follow exposure to cold draughts of air. In riding through the coast region a man is, for half an hour, while crossing a valley and climbing hills, half melted under the sun's burning rays, when there is scarcely a breath of air in motion; then as he reaches the top of the hill he suddenly encounters a cold wind that in a few moments chills him through, and he needs winter clothing. Yet on the whole compared with most other countries, the climate of Natal is healthy and conducive to long life.

The *Geology* of this portion of Africa has been but little studied by scientific and capable men, and we venture to add but little to what we have already interspersed with the foregoing remarks. The perpendicular sides of the table lands and mountains is a feature that strikes every one. Nearly all the highlands are capped with strata of coarse red sandstone, which are almost perfectly horizontal, and from ten to five hundred feet thick. Underneath the sandstone are lying primitive rocks, chiefly granite. In some localities pure white quartz abounds in mountain ranges. Large sections are occupied by the trap rocks, and these are often lying in greatly contorted and elevated strata. Along the sides, and up to the tops of the highest lands, the rocks have been apparently much worn by water. Evidently all this country, in remote ages, was once submerged beneath the sea. Marine shells are found hundreds of miles inland, at elevations of five thousand feet.

Many of the rounded hills occurring in the deep valleys are *moraines*, formed doubtless by currents of water. Within fifty miles of the coast, nearly all the streams flow in beds of granite, gneiss, basalt, sienite, quartz, slate and ironstone, or greenstone. In their channels are found large boulders of sandstone, which came from the heights above, and of almost every other variety of rock, young and old. All varieties of quartz are found in the rivers and on the less elevated hills. That of a pure white, and of a rose color, is most abundant. In some of the alluvial deposits near the rivers, at the depth of two or three feet, are *unworn* fragments of white, and the most delicately tinted rose quartz. On the hills, in the vicinity of Natal Bay, beautiful crystals of quartz abound, having the same crystalline structure as the amethyst. They may be perhaps called a coarse variety of that precious stone, and they vary in color from white to a deep purple. Such varieties of quartz as *flint*, *hornstone*, *chalcedony* and cornelian, are common. Jasper, tourmaline, beautiful feldspar crystals are sometimes met with.

Along the beach, and protruding from the water, alternate sections of sandstone, granite, greenstone conglomerate, or a kind of pudding stone, and basalt succeed each other, each from a dozen rods to half-a-dozen miles in extent. From the Umpambinyoni river, on the South-west to the Amanzintote, a distance of 40 miles, is a continuous mass of greenstone conglomerate, surmounted about midway by Infumi hill—a pile of sandstone two or three hundred feet high above the plains, and three or four miles in circumference. Imbedded in this greenstone are innumerable fragments of freshly fractured quartz, fillspar, mica, sienite, jasper, flints, slate and even sandstone, and also mixed with these are well worn pebles of the same varities of rock. The imbedded fragments are of all sizes—some as small as a mustard seed—some many tons in weight. In the vicinity of the lower ford of the Umkomazi river, this formation is not less than five hundred feet thick.

The same strata appears near Pirtermazitzburg, and perhaps still further inland, and to the North.

But little lime, and none of pure quality, has been discovered near the coast. The lime used in the colony is made from shells and corals, or imported, chiefly from Mauritius. Large banks of shells—land and sea shells intermixed—are found many feet above

the present level of the sea, along the beach. Coal has been found in several localities, near Pirtermazitzburg, at the junction of the Umzingati and Utukela rivers, and on the coast North of the Umgeni, but not in quantity or quality to pay for bringing it to market.

Copper and lead have been discovered, but not in abundance. Plumbago is found near Maritzburg, and is said to be of good quality.

Of late the hope of finding gold in this colony has attracted much attention, but hitherto all search for it has been unsuccessful. Compared with the geological features of the gold fields of California and Australia, there is reason to think it will yet be found in Natal.

Fossils, so far as we yet know, are not abundant. Ammonnites, and a few other specimens, have been found near the coast, and at higher elevations inland some other varities. Fossilized wood is found to the South-west of the colony on the coast. The country needs yet to be thoroughly explored, in order that we may know its mineral riches, and the contributions to science it has in store.

The *Zoölogy* of Natal is similar to that of other portions of South Africa. Here are elephants, lions, buffaloes, leopards, panthers, wolves, hyenas, wild dogs, jackals, wild cats, alligators or crocodiles, sea cows, elands, antelopes, many varieties of bucks, monkies, and baboons, wild boars, porcupines, ant eaters, and many kinds of smaller animals and reptiles. Serpents are abundant and many of them poisonous, though they are not usually aggressive in their disposition.

Not unfrequently, serpents whose bite would be fatal, together with scorpions, spiders, and other venomous reptiles and insects, are found in our houses and bed-chambers, or hanging from trees under which we pass, and concealed in the narrow paths. Not unfrequently natives die of the bite of serpents—their habits greatly expose them to their venom. All kinds of lizards abound, and they, as well as numerous varieties of chameleons, make themselves everywhere at home—not even respecting the sanctity of our closets and bed-chambers.

A reptile about eighteen inches long, in general appearance like the American striped snake, is sometimes found and exhibited as a great curiosity, it having, about one-third the distance from head

to tail, two legs or fins about one inch in length—"*a serpent with legs.*" Whether this reptile is known to naturalists I cannot tell. There is one described somewhat like it.

Insects abound in annoying and countless variety. The cosmopolite musqueto, and house-fly are every where. There are many varieties of ants, but the most pestilent of these is the white ant with which the ground is every where filled. They throw up large mounds of earth, penetrate and pervade the walls of houses—eating out window and door frames and even beams and rafters, standing trees are devoured by them, and if a bit of timber, not of the hardest quality, is left on the earth for a few days it is eaten up. They always work under cover—they approach an object either under ground, or under a hollow wall, which they build before them, reminding one of the "*testudo*" under which the old Roman soldiers approached the armed walls of a city. They undermine houses, go through lime, mortar and burned bricks, and unless the houses are constructed of timber which they will not eat, they soon fall a prey to their depredations. The quantity of soil they will remove in a short time and cement together, is perfectly amazing, when it is seen how small an insect they are.

Locusts are numerous, and not unfrequently they eat up every green thing in some districts. Thousands of different kinds of beetles have been sent to Europe from Natal. But perhaps the most troublesome insect to both man and beast is the bush tick. During the warm season, in the coast division, they are a perpetual torment. On every spear of grass they await the passing of some living creature, to which they tenaciously cling, bury their heads in the flesh, and not content with sucking the blood, infuse a subtle poison, which inflames the skin, produces an intolerable itching, and breaks out in painful and obstinate ulcers. Though at first so small as to be scarcely visible, having fastened themselves to an animal, they increase in a few days to the size of the end of a man's thumb—then drop off and breed millions more. They penetrate deep into the ears of cattle and if neglected often cause death.

The *Conchology* of Natal has been but little investigated, but what is known is interesting, and gives promise of a rich harvest to the lover of this branch of science. Of eight or ten varieties of land and fresh water shells sent to a Conchologist in New York, five were unknown to naturalists. So great a curiosity is the large

striped snail-shell seen here, even in England, that specimens of it there sell for a guinea each. A beautiful minute transparent shell is found on the under side of aquatic plants which has attracted the attention of scientific men. Out of 180 specimens of land and sea shells sent to England by Dr. Stranger, Surveyor General of Natal, upwards of fifty were new to the English Conchologists. Along the sea shore are found excellent oysters attached to the rocks, and at low water fine muscles and other shell fish can be obtained. Fish abound in all the rivers, and salt water varieties may be taken at the mouths of the rivers and in Natal Bay.

Africa has been called " a land of rivers without water—of birds without song and of flowers without fragrance." However true this may be of some portions of this continent, it is in no respect true of Natal. Birds are here in endless variety, of surpassingly beautiful plumage, and of notes as sweet as those which sung in England and under European skies. The Whippoorwill—just like the American but with an addition of three short notes to his song, all night long vocalizes the groves with music. The turtle-dove is here, whose soft melancholy voice almost starts tears to the eyes of him who listens. The "izuisingise" whose concert notes are like the distant sound of "all manner of instruments," floating over a tranquil lake, are alone sufficient to redeem Natal from the slanders so far as regards the feathered tribes. Happy is he who living in Natal beside some of our little groves, rise betimes to hear the morning hymn of praise ascending, from thousands of rejoicing birds up to him who tuned their voices to melody.

Of birds of prey, are the vulture, the eagle, various species of hawks and kites, and many others. Here are found the crane—various kinds of the ibis, Egypt's sacred bird—both black and white—the flamingo—the bustard, the pou—a kind of wild turkey—the swallow, the pheasant, the partridge, the guinea fowl—domestic fowls—the honey bird—species of the parrot—the lowrie the humming bird, finches—woodpeckers and unnumbered others. The plumage of some is exceedingly brilliant and beautiful.

The *Botany* of Natal is but little known to the scientific world. We know of but one attempt having been made to describe and systematically arrange South African plants. William Henry Harvey, Esq., in 1838 published a book called the " Genera of South African plants, arranged according to the natural system."

This book professes to embrace only the vegetable productions of Cape Town and its vicinity. In analyzing South African plants, all European and American Botanists are deficient, for while by their aid nearly all may be traced to *genera*, the specific differences are not described. Very many of the flora of this colony have the same general character as those known in other parts of the earth, but we have not yet seen one indigenous to South Africa that does not present some specific difference.

To a foreigner from the temperate latitudes of Europe or America, the general appearance of the vegetation of this country reminds him most forcibly that he is far away from the land of his birth; but as he becomes more familiar with the flora, he soon discovers that he is not on another planet; he is pleased to recognize many familiar family resemblances; the grasses, the trees, the brilliant flowers, though in foreign accent, all tell him of the sweet fields, the woodlands, the green banks, vales and hills of "the old familiar places," the home of his youth. It would be impossible in the limits of this paper, to do more than mention two or three trees which are peculiar to this quarter of the world. The tree which, after going a few miles from the Natal Bay, most attracts the attention of the stranger, is a species of the Euphorbia, which in its general appearance to a cursory observer resembles a gigantic cactus, and has been, by those not well versed in botany, mistaken for that American plant. It reaches the height of thirty or forty feet, is one or two feet in diameter just above the roots. It seems to be destitute of proper leaves, but sends forth immense quadrangular branches instead, which are always green, and on the extremities of which is produced the flowers and fruit. An exceedingly acrid white juice exudes from the bark, if punctured. The mass of the tree is usually like a sugar loaf or globular. There are several other varieties of the euphorbia, one of which never rises more than one foot above the surface of the earth, and is often two or three feet in diameter.

Another singular tree—an evergreen, and very beautiful in its form and foliage, called by the natives *Umtonibi*, from the great quantity of juice which flows from it when wounded, usually commences on or near some other tree, sends out tendrils, each one of which becomes a branch, and this again tendrils in turn, which often return again and grow into the original trunk. Soon the tree

around which they clasp is suffocated and killed in their embrace. This tree may be a species of *banian* which is so remarkable in the East Indies.

There are great numbers of Orchids in the more extensive forests. The castor oil nut abounds, and is used by the natives for the manufacture of oil with which to smear their bodies. There are several varieties of the indigo plant, of wormwood, mints, and spicy bushes. Several nuts are found yielding oil, or good for food, and and great numbers of wild berries and fruits. The *Itungula* is large as the largest plums, is red when ripe and is a delicious fruit. It is produced in great quantities near the coast.

The tree producing gum arabic grows here in great abundance. The liliaceous plants are found here in great perfection and variety. One, called here the Natal Lilly, exceeds in size and beauty all we ever saw in colder climes of this order of plants. The gladiolus here reaches a great size and perfection, and is not stunted as we have seen it when removed from its native soil.

The calla is very much larger than is ever seen where it is an exotic in colder regions. The bell of the flower often measures five inches across. Of grasses there is an endless variety, and many produce beautiful flowers. Clover is found wild and is very fragrant, resembling the white clover, but with a purple blossom.

We have only just pointed to the treasures which are in this country for naturalists; we hope for the time when they shall be appropriated and classified by men of science. Then shall the treasures of beauty, and wisdom, and power, which God has lavished here, and which only the blind eyes of savages have hitherto beheld, and none appreciated, declare to his creatures the glory of Him who paints the flower and upholds the world.

Umtwalume, Natal, Sept., 1852.

ARTICLE IV.

INTER-OCEANIC COMMUNICATIONS

ACROSS THE ISTHMUS OF PANAMA, OR "DARIEN."

BY GEO. B. WATTS.

After all that has been written on this interesting subject by learned men and travellers, from the period of the celebrated Humboldt's visit to Spanish America up to the present time, it would appear presumptuous in me to attempt to throw further light thereon, had I not been encouraged by a respected Member of your distinguished and popular Society to submit these few observations to your consideration.

But though thus emboldened and encouraged, I must still crave your kind indulgence, observing that I have written this brief sketch under the disadvantageous circumstances of being a transient resident in this city, and thus unable to refer to my journals, maps, and other aids to memory.

I here tender my thanks for Mr. G. Schroeter's valuable services, kindly proffered by your Society. He has sketched a chart of the Isthmus, (now before you) according to the data I was able to furnish. It is, of course, an incomplete representation, but it will serve as a guide until more accurate information be obtained (Note A.) On my return to Carthagena, I shall be happy to furnish you with more extensive data, to enable your Hydrographer to form a better Chart.

The peculiar and remarkable position of this narrow neck of land,

denominated by some, the "Isthmus of Panama," by others of "Darien," (B.) connecting North with South America, has, for centuries past, engaged the deep and earnest attention of Europe. Some opine the latter name should not be given to it at all; (Encyclopedia Britannica) others divide this Isthmus into two, under these respective names, (Dr. Cullen, &c.) Humboldt states that "Darien" was the name vaguely given to all the Coast that extends from River Damaquiel to Point San Blas 24 long. Latterly it has become, since the acquisition of California, Oregon, &c., an object of particular and paramount interest to this country, which is called, or I should rather say, *destined* to play so important a part in the future concerns of the *New World*, and hence must ultimately influence and react on those of the Old World.

Yet, notwithstanding all the different explorations hitherto made on this Isthmus, and its neighborhood North and South, I venture to say, that much ignorance still prevails of its various localities, rivers, lakes, &c. This has arisen from the great difficulties that have been encountered in traversing and exploring an unknown country, interspersed with ranges of high mountains, rapid and circuitous rivers, immense swamps, lakes, &c. It is also very thinly inhabited by a wild, warlike and unconquered tribe of Indians called in Spanish "*Cunos*," scattered all along the San Blas Coast, extending on the *Atlantic Borde only* of the "Darien" Isthmus from Porto Belo to the Western extremity of the Gulf of "Uraba." Those Indians therefore, occupy only *one-half*, and that the narrowest of the whole length of said Isthmus. It will be observed that the chain of the Cordillera of the Andes runs nearer to the Atlantic borde, than to the Pacific Coast. The "Cuna" or "San Blas" Indians have their settlements at the head waters of the different rivers that descend into the Atlantic, or as it were on the top range of the Mountains, are therefore well acquainted with the passes or gorges thereof, and can pass from sea to sea in a very short space of time, as we shall presently prove.

The Spanish Government made several strenuous but ineffectual attempts to subdue and even exterminate these fierce warriors. After a lavish expenditure of men and money, the undertaking was abandoned. Forts were erected on the Pacific side to keep them in check, and protect the miners engaged in extracting Gold; the richest mines having been discovered in that quarter, (G.) Some

of these Forts are said to exist to this day, to wit: *Fort Principe,* on the "Savannah" River, and Fort "*Terrible*" on the "Chepo" River. There are doubtless many others scattered along the Pacific Coast, for it must be borne in mind that this *neck* of *land* was the point where the Spaniards made their *first settlements*, and built several towns, long since abandoned, owing to the untiring attacks and depredations of the "Cunos."

The famous Buccaneers of old, who, in their turn, endeavored to avenge on the Spaniards, the cruelties they had practised on the poor and unoffending Indians, formed a *league* with them, befriended them on all occasions, and with their assistance, were enabled to *cross* and *recross* this Isthmus of Darien in various directions, in their expeditions to plunder the rich Spanish settlements located along the Pacific Coast.

It will be, I trust, deemed interesting to refer here, amongst others, to *Dampier* and *Wafer*, who in 1686 *crossed* and *recrossed* this Isthmus, and published the details of their wanderings. From their works I have culled some extracts, equally curious and important, though written nearly 200 years ago, and more particularly so from the recent explorations that have been made on the Isthmus under the patronage of the Government of the United States in conjunction with those of England and France. They will afford some singular points of comparison, worthy of serious attention and reflection.

These Voyagers though they accompanied the Buccaneers in their several expeditions, have been considered *worthy* of *credit*, and are quoted as good authorities. I at least, have found their statements to be strictly correct, from the opportunities I have had of observation in my wanderings through parts of that interesting country. The Encyclopedia Britannica makes mention of them "as men of considerable observation."

The former describes his first journey across the Isthmus of Darien in the following quaint and succinct manner.

"It was shortly after Christmas Day, 1679, when we set out. The "first expedition was to Porto Belo, which being accomplished, it "was resolved to march by land over the Isthmus of Darien upon "some new adventure on the South Seas. Accordingly on 5th "April 1680, we went ashore on the Isthmus near "Golden Island" "(adjoining the Isle of "Pines") one of the *Sanbalves* (San Blas ?)

" to the number of 300 or 400 men, carrying with us such provisions " as were necessary, and toys wherewith to gratify the wild In- " dians, through whose country we were to pass. In *about nine* " *days* we arrived at " Santa Maria" (see Map) situated on a river " of the same name, (called also in some maps " Darien" or " Tuyra") " and took it, and after a stay there of about three days, we went " out to the South Sea Coast, and there embarked in such canoes " and " Piraguas" as our *Indian friends* furnished us withal." Dampier Voyage, vol. 1, page 3.

Here we have the fact of a party of 300 or 400 men *crossing from sea to sea* by the route you will see tracked out on the map, in the short space of *nine days*, without any material accident befalling them. I call your particular attention to this fact.

I will now briefly refer to Dampier's account of his return from the south Sea or Pacific, to the north Sea or Atlantic, some time after. A quarrel arose among the Buccaneers, on a division of booty; he with others separated from the main party and *recrossed* the same Isthmus.

After describing the journey, and the various difficulties encountered; that he was obliged to live amongst the Indians; the Surgeon, Lionel Wafer, and four men, from an accident that befel Wafer, (who scorched his knee with gunpowder,) and that he landed near " Congo" river, (see map) travelled northeast, crossed the head waters of the " Chepo" river, and over high mountains till he came out at the " Conception river on the Atlantic, opposite La Sounds' Key, one of a cluster of Islets in the splendid Bay of " Mandingo," he thus concludes his narrative at page 23, vol. 1.

" Thus we finished our journey from the South Sea to the North " in 23 *days*, in which time, by my account, we travelled 110 miles, " crossing some very high mountains; but our common march was " in the vallies among deep and dangerous rivers. At our first " landing in this country we were told that the Indians were our " enemies; we knew the rivers to be deep, the wet season to be " coming in, yet excepting those we left behind (Wafer and his " companions, who subsequently reached the Atlantic coast with " one casualty,) we lost but *one man*, who was drowned. Our first " landing on the South Coast was very disadvantageous, for we " travelled at least 50 miles more than we need have done, could " we have gone up the " Chepo," or " Santa Maria " Rivers; for at

"*either of these places a man may pass from sea to sea in three days*
"*time with ease. The Indians can do it in one day and a half*, by
"which you may see how easy it is for a party of men to travel
"over. I must confess the Indians *did assist us very much*, and I
"question whether we ever had got over *without their assistance*,
"as they supplied us with provisions, &c., &c," (D).

If we compare these feats of the Buccaneers with the miseries and hardships endured, and length of time occupied by the gallant Lieut. Strain and his party, as lately reported in the papers of this city, we cannot but conclude and regret that the friendship of these San Blas Indians had not been previously obtained. And I may be permitted to observe that the neglect to do so was the chief cause of the failure of the three recent explorations. (E).

We read as an historical fact, that some years afterwards, in 1698, an obscure Scotchman, Patterson, conceived and achieved the idea of founding a colony on the Isthmus, doubtless with the ulterior view of opening an Inter-Oceanic route. He mingled with some of the old Buccaneers, obtained every information from them, and selected a point now known as Port " Escoses," (Scotch) in the Bay of *Caledonia*, where he built a town, *New Edinburgh*. But Patterson following the example of the famous William Penn, first entered into a *treaty* with these " Cunos," *purchased land of them*, and made them *his allies*, as he no doubt intended afterwards to make them his converts. It is unnecessary here to refer to further particulars beyond the fact. After two expeditions of 1200 Scotchmen each, the infant colony, from want of proper support, the jealousy and intrigues of the Dutch East India Company, the opposition of the government of England, and the war with Spain, dwindled away from starvation and disease. The remnant was attacked by a Spanish Force and barbarously destroyed, much to the regret of the Indians. These in after years severely revenged the destruction of Patterson's Colony, and retaliated for the former atrocities of the Spaniards. During the late war of Independence, one of the Indian Chiefs penetrated up the river " Sinu," destroyed Sorica and other villages, plundering and burning them, and massacred the inhabitants, Spaniards in language, though their descendants.

This renowned Indian Warrior was still alive when I visited the San Blas Coast, in 1838. He was said to be nearly 100 years old,

was still hale and robust, and he still hoped to kill many a Spaniard. He much prized a handsome Spanish gun he had taken in battle with which he boasted he had killed scores of them.

This hatred to the Spanish race and descendants still rankles in the "Cuno's" breast. And I beg to call attention to this circumstance, that these San Blas Indians (until lately) obstinately refusing to have intercourse with those who speak the *Spanish language*, have, ever since the time of the Buccaneers and Patterson, maintained their alliance and intercoruse with the English and Americans, whom they consider as one and the same nation from the unity of language, and have ever since exclusively traded with them. (F.) They are however very jealous of any attempts to explore the interior of their country, and have foiled them by force or stratagem, as the late exploring parties, and others, includding myself, can testify. Their country abounds in *very rich gold mines*, &c., *to wit:* the famous mine of "Canna," and others, but recollecting full well that the insatiable thirst for that metal was the great incentive that attracted their persecutors, the Spaniards, to their country, and led to the perpetration of horrid cruelties against them, (see Humboldt, &c.) the Indians never wear any ornaments in their intercourse with strangers. They appear even to be ignorant, when interrogated, of the existence of such a metal.

I venture to say that even after all the late occurrences, if the principle pursued by Penn and Patterson so wisely, were still properly carried out by treating with the different Chiefs, their co-operation could be gained to explore the whole Isthmus, thoroughly and carefully before any particular route be undertaken, a course recommended by the learned Humboldt. Mr. Lionel Gisborne states his conviction of the same idea, (see Journal) but I have yet to learn that either he or his colleagues pursued it in their recent explorations.

I visited the San Blas Coast 16 years ago, emboldened by the perusal of Wafer's and Patterson's adventures, and charged with the mission of circulating the Scriptures amongst such as could speak English and Spanish. I also had in view to study their language and form a grammar thereof, with the intention of translating the New Testament in their dialect. I landed at different points, hunted with the Indians, until I gradually approached "Carreto," near Port Escoses (see map). Here we anchored and

traded with them. I had formed a party to assist me to hunt the "Danta," a species of the Tapir, an amphibious animal, the size of an ass. In my eagerness to point out the route we were to take, I incautiously spoke of the different rivers flowing into the Pacific, and made certain enquiries, thus betraying a certain knowledge of their country. The suspicions of an Indian, one of our sailors, were aroused, he started that very evening to acquaint the Chiefs, travelling all night over the mountain passes. A council was held, and the opinion formed that I must be an emissary from the King of England sent to explore the country, with a view to its ultimate seizure. The Indians flocked to arms, and to my surprise, the following morning, whilst loading my rifle &c., the Captain came on board, and announced the commotion, stating that if we did not leave instantly, the Indians were coming to capture me. Here ended all my hopes of exploration, &c., and I ran down the coast to the "Atrato" river, of which more hereafter. A Wesleyan Missionary, Mr. Staunton, accompanied me on this occasion. He afterwards visited other parts of the coast, was kindly received by the Indians, but being destined for the Honduras mission, he was obliged to proceed on his voyage. Could this Isthmus be properly explored, I feel convinced, that an advantageous inter-oceanic route would ultimately be found; but I repeat, the Indians must first be propitiated by certain rules of diplomacy peculiar to themselves.

I will now proceed to take a brief review of the different routes that have been commented upon by Humboldt and subsequent travellers, some of these are nearly completed, (Panama and Nicaragua routes,) others are in agitation, others are still unexplored. I will then point out *other* localities, which I am not aware have as yet been made public, and which I have reasons to believe may prove more feasible and advantageous than all the others. I will state them in the order of their position, beginning at the most northerly in Spanish America, and concluding at the most southerly. Capt. —— Fitzroy in his recent researches, read before the Geographical Society of London, enumerates *seven* different routes. I will now submit to your consideration *eleven* points for inter-oceanic communication by Railroad or Canal.

1st. We have the Isthmus of *Tehuantepec* in lat. 16° 88″ between the sources of the rivers "Chimalapa" and "Del Passo," running into the "Huasacualee." So much has been written about

this route that it is needless here to add more. It does not appear however adapted for a *Ship Canal*, all other difficulties being surmounted, from those presented by the harbors, and pronounced to be insurmountable.

2d. Is a project to construct a *Railroad* through the *Province of Honduras* from *Port Caballos* on the Atlantic, to the Bay of *Tonseca* on the Pacific. The distance is said to be about 150 miles, and the harbors on both sides are described to be good, capacious and secure. The waters of the river *Goascoran* interlock with those of the *Humaya* and *Ullua*, almost midways of this Isthmus, the two latter emptying into the Atlantic, the former into the Pacific. In case steamers drawing seven feet water be run up these rivers, the distance will only be 100 miles of railroad. After passing the coast of the Atlantic borde, the climate is very salubrious. The advantages of this route over all others are stated to be that it shortens considerably the distance between the Atlantic ports of this country and California, Oregon, the Sandwich Islands, not less than 1,250 miles over Panama, 800 or 900 over Nicaragua, and from 60 to 100 over Tehuantepec. A charter very favorable, has been obtained of this route, for seventy years; a Company has been formed and contracts have already been made for the construction of the road. Medium Lat. 14 28, Long. 87, 39.

3d. We find the *Nicaragua* route, Lat. 10 12″. This being in full operation, is already too well known to require any further notice here. It is not however adapted for a Ship Canal, and there is still room for great improvements on the present transit.

4th. We find a point in the Province of Veragua (adjoining that of Nicaragua,) the most eastern of the Republic of New Granada, that presents advantages for a Railroad, &c. Drawing a line from the Chinqui Lagoon, on the Atlantic side, opposite Bocas, del Toro, almost parallel to the Pacific, due north to south, and intersecting the towns of Belen and David The intervening country is represented to be a continuation of Savannahs, interspersed with low hills, affording great facilities for a railroad, and even a Canal. There are good harbors on either side; the climate is healthy, the natives are very docile, chiefly employed in breeding cattle; provisions are very abundant and very cheap. A charter was granted two years ago to Mr. Theodore Moore of this country, by the Legislature of Veragua, to construct a plank or railroad at this point.

I know not if the route has been surveyed, or in what state the project is at present. The Panama Railroad Company consider this charter an infringement of theirs, and have opposed it. Hence it can be used only as Provincial road, if it be ever completed.

5th. Is the *Panama Railroad*, also too well known to need a description. It appears that when completed, this will be the most perfect railroad route, as yet in operation. I venture to obtrude my opinion that it would have proved far more advantageous to have at once made a *Ship Canal* here as suggested by Col. Lloyd, (see Philos. Transactions,) whatever might be the ultimate cost.

6th. Is a point considered to be the *narrowest* of the whole Isthmus; according to Humboldt *only* 25 *miles.* A large Bay "*Mandingo*" indents it deeply on the Atlantic Borde, into which flows a river which he calls San Juan Diaz; others term it *Mandingo* river. The waters of this in the *rainy season*, (about ten months in the year) are said to communicate with some tributary of the *Chepo*, a large river discharging into the Pacific. The *Cuna* Indians are known to push their canoes across, and thus pass with facility from sea to sea, in their intercourse with the tame Indians of the Pacific coast. The Government of New Granada some six years ago, sent a Mr. Hopkins, (Mineralogist) to survey this route, doubtless considering it the most feasible. He ascended the *Chepo* as far as the town of that name situated thereon, which is the boundary line between the *tame* Indians of the Pacific and the *wild Cunos* of the Atlantic Borde. I learned afterwards that the latter refused to allow him to pass through their territory, though he offered them presents of gew-gaws, and other tempting inducements. The expedition failed, and I conversed with Mr. Hopkins on his return. This is a point which well deserves the attention of future explorers. The Harbor on the Atlantic side is large, secure, and unsurpassed perhaps by any in the world, opening in the splendid bay of Mandingo, studded with clusters of beautiful islets, much resorted to by the coasters. That of *Chepo* on the Pacific, is represented to have a bar across its mouth, but should all other difficulties be surmounted, to render it at some future day a *Ship Canal* route, this impediment would be eventually overcome.

7th. We now come to the route recently known as Dr. Cullens', from some point in the bay of Caledonia on the Atlantic, to the river *Savanah* debouching into the Gulf of San Miguel (Michael) in the

Pacific. It is not so called I presume because he first discovered it, for I have already shown it was familiar to the Buccaneers, Patterson, &c., nearly 200 years ago. The Spanish Government also had all this section of country explored by several officers, and their maps are perhaps the most correct that exist, (see map in possession of Mr. E. G. Squier). But Dr. Cullen has lately taken a conspicuous part in promoting the exploration thereof, and the result is before the public. I may be premitted here to express my doubts that he ever crossed the Isthmus from *sea* to *sea* through the wild Indian Territory. I am aware that he *twice ascended* the Savannah, from the Pacific side, and *may have* caught a *glimpse in nubibus* of the Atlantic from some eminence; (the same as Mr. L. Gisborne, and more recently the Virago exploring party) but I feel confident he has never crossed over and *come out on the Atlantic side*, whence he could with ease have proceeded to Carthagena, where I was residing at the time. It is rather strange that each exploration *concluded* on the *Pacific side*, whence he returned via Panama and Aspinwall to Carthagena, rather a circuitous route. From Carreto or Port Escoses he could have reached Carthagena in two or three days. The results of the three late explorations will soon be published, rendering premature any comments at this moment. It is, however, deeply to be regretted that so many valuable lives have been lost, and so many more endangered; which may be supposed might have been avoided, had the good will of the Indians been properly conciliated, as it was understood that Dr. Cullen had the peculiar talent to accomplish, from his long intercourse with Indian tribes, and from his having been espoused to the Indian Chief's daughter of five years old.

8th. Next our attention has been directed by Humboldt, to the *Isthmus* of *Cupica* and *Napipi* between lat. 6° 40′ and 7° 12′. This point was then supposed by him to be the most feasible route of all those indicated by his observations and researches. But I would here remark with all due deference to his unquestionable authority in other respects, that he quotes information he received thereon from Don Ignacio Pombo Prior, of the Consulado or Chamber of Commerce, at Carthagena. The descendants of this distinguished individual are still in that city, and I am personally acquainted with several members of that respectable family. But it must be remembered that Senor Pombo writes to Humboldt with

reference to other parties that the intervening country between the head waters of these two rivers was *a perfect level.* As I visited this spot 16 years ago, and *walked over the ground,* I can safely assert that several hills intervene, not less than from 600 to 800 feet high, approximately. I ascended the Napipi in a canoe, till I reached the head waters of navigation, at the *Tambo de Antado*, or house of shelter for travellers, where I landed. I employed about four hours walking leisurely with my rifle and the two Indian guides, shooting snakes, bears, and other animals. Being unaccompanied by a scientific person, I could only make general observations. About 40 miles from the mouths of the Atrato, you enter the *Napipi*, running from West to East, in a tortuous course. It may be made navigable for steamers not drawing over six feet water. I reached the Tambo in two days, from the mouth of the Napipi. I here found an old mule track, opened by an enterprising Spaniard, who used to convey merchandise from the Bay of Cupica to the Tambo, whence he sent it by water to Quibdo, the Capital of the Province of Choco, and other towns. After ascending a succession of three or four hills, I suddenly reached the *summit* whence I enjoyed a fine view of the Pacific, Bay of Cupica, and river of same name entering it by the North, and running due East to West. The descent to the Bay of Cupica is very sudden. I ran down the major part of the distance, and plunged into the water of the long-wished for Pacific, which I then saw for the first time, and could appreciate fully the feelings of other travellers on a similar occasion. The head waters of these two Rivers, Napipi and Cupica, appear almost to interlock, and the intervening distance does not appear to be over four or six miles. This is the problem that has to be solved, whether a Canal can be cut so as to connect them, and complete the uninterrupted navigation between the two seas. The Bay of Cupica is small, in the shape of a basin, apparently well protected, and is resorted to by vessels running up and down the Pacific Coast.

I ascended the Cupica for a whole day in a small canoe, paddled by two Indians. As far as I went, some twelve miles, I found it sufficiently wide and deep for steamers of a large size. Not having carried any instruments to determine heights and distances. I did not traverse the hills between the two rivers. The Government of New Granada granted a Charter to Messrs. Gonsales & Cardenas, natives, about three years ago, to open this route. But the term

of 49 years was not sufficient to induce capitalists in Europe to risk the undertaking. Senor Cardenas and suite on their return to New Granada, were destroyed in the unfortunate "Amazon" steamer. The Charter expired from non-fulfilment of some of its articles. This route is therefore unsurveyed hitherto. Besides Humboldt's opinion, there occurred a circumstance some years ago that tended to convey a favorable idea of the facility of transport across this Isthmus. It is an historical fact that during the late war of Independence in January 1820, Admiral Illingsworth of the Columbian Navy, anchored in the Bay of Cupica. The vessel's launch was dragged by the sailors across the hills, and Colonel Cancine with others *descended* the Napipi therein, and *ascended* the Atrato as far as Quibdo or Citara. This manœuvre enabled him to surprise and route a Spanish force in that neighborhood. The launch was left at Quibdo for many years, till it fell to pieces.

I met in the Bay of Cupica, a large Peragua, with Indians from Chepo, and the Gulf of San Miguel. They offered me a passage, but having left all my luggage at the mouth of the Napipi, I was prevented from exploring that interesting section of country, and following Wafer's route to the Atlantic Borde. The Indians in this vicinity, belonging to the Pacific side, have been partially converted to Christianity and are therefore called *tame* or "*mansos*"; having been baptized. They speak a little Spanish, wear only a piece of *bark* round the loins, which sticks out astern like a monkey's tail. They dye their skins of different colors, blue, black, and red, to preserve their bodies—alike from heat and insects. They live on monkies and other game, which they kill with great dexterity with the *Bodoquera*, a hollow reed about twelve feet long, made of two pieces of hard Palm wood, ground smooth with sand and bound together. They blow small poisoned arrows through these *silent guns* as they term them, and kill their game with great dexterity, bringing down birds from the highest trees with unerring aim. I tried to learn this novel method of shooting, but soon desisted, as my mouth began to swell from incautiously touching the poison with my lips. The arrows are of two kinds, one slightly poisoned for killing their game, and therefore innocuous, the other a deadly poison for despatching an enemy, who dies quickly. I hunted with these "*Indios mansos*," and whenever we approached the Border ground of the "Cunos or Indios Bravos," I observed great precau-

tions and fear displayed. The latter have learned the use of the gun and rifle, from their intercourse with the English, &c., called the "speaking gun," which the former dread as much as these last the "*Bodoquera*" or "silent gun." I was offered any price for my rifle, and only retained it, by promising to bring some for sale on my second trip. Hoping this digression will be excused, I return to my subject.

9th. There is still another point called the Isthmus of *San Pablo*, a narrow strip of land that separates the river *Quito*, (a tributary of the Atrato, entering it opposite *Quibdo*, from the San Juan, flowing east to west, and discharging into the Pacific at the Port of *Chirambira*, a few miles north of that of *Buenaventura*.) Both rivers are navigable for steamers of six and eight feet water draught. The summit level does not exceed 116, and following certain gorges or vallies, may not be found to exceed 80 feet. A railway or canal for small steamers is quite practicable, the drawback to this route is the long internal navigation, ere the Pacific can be reached, to wit: about 250 miles up the Atrato and Quito, and about 100 miles down the San Juan. The Government of New Granada has granted a Charter to Messrs. Gooding & Varregar for I think sixty years. Two surveys have already been made of this route, and a third expedition has started this day, to rectify the above, and with a view to further explorations of the different rivers that fall into the Atrato, whose head waters interlock with others debouching into the Pacific. The width of the Isthmus of San Pablo, where there is a village of that name, does not exceed *five miles*, is almost a perfect level with only two small hills; the waters of different streams, tributaries to the Quito and San Juan, interlock at their summits. Merchandise is at present conveyed across on men's backs, strapped on to a chair of bambo "motete" which is suspended by a band over the forehead, thus throwing all the weight on the shoulders, even women and children are thus employed like beasts of burthen, and it is surprising to see what heavy loads they can carry, and how nimbly they pass over logs of slippery trees roughly notched, with only a stick in their hands. The cost of conveyance varies from six to eight dimes per 100 lbs. weight, and the distance is travelled over in about two hours. In the neighborhood of *San Pablo* is the *Cano de Raspadura*, referred to by Humboldt, as the spot where formerly a ditch was dug by direction of the Curate, through

which canoes were passed from river to river. But *San Pablo* is considered the more advantageous locality for a canal, &c., as it cuts the river San Juan *lower down*, where the stream is broader, deeper, and with fewer rapids.

These remarks are made from personal observation, having co-operated in the survey of this route, whence I have lately returned. The climate of the Choco is not so unhealthy for foreigners as is generally represented, taking the proper precautions as the natives do. It certainly rains during ten months of the year, but this renders the air much cooler than on the sea coast. The natives enjoy good health; but living so constantly exposed to *wet* exposes them to different cutaneous eruptions, and the river fish being their chief food must tend to impoverish their blood. All the boatmen on the river are spotted all over their bodies with the "*carate*" or eruption, which is not at all dangerous, and which they take no pains to cure. I was for several months exposed to sun and rain, frequently wading through rivulets for hours at a time, and only caught a slight cold. We hardly saw *three snakes* in all our rambles, though we crossed the woods in all directions, where perhaps no human being had ever before penetrated, and yet the Choco is considered par excellence the nursery of all the most venomous snakes known in the world.

Having taken a brief review of all the *nine* routes hitherto referred to by travellers, I will now submit to your consideration the result of my observations and those of others, and direct your attention to *other two routes* which have hitherto not been sufficiently explored, are almost unknown, and may, perhaps, offer *greater* facilities than any of the preceding for the formation of a *ship canal* navigation from ocean to ocean, this being the grand desideratum now sought for and required.

10th. About 15 miles from the mouth of the "Atrato" river, on the right or western side ascending, there is a river called *Arquia*, which, running from west to east into the "Atrato," has its head waters intersected by some river that discharges into the Gulf of *San Miguel*. I was assured of this by the natives that frequent these waters, and hunt in the vicinity. At the time I entered the *Arquia* I found it impossible to penetrate any distance up, owing to large masses of grass, weeds and logs that obstructed its navigation, and I was unprepared with the requisites to cut my

way through. I was also debilitated from fever, the fatigues of my wanderings, want of provisions, &c., (we had lived for many days on the meat of the "Manato," or sea cow, salted) and I found it required considerable more time and expense than I could at the time well spare. There is here evidently a gap in the Cordillera of the Andes. The surrounding country is low, and is always overflowed by the waters of the Atrato, that spread out here previous to entering the Gulf of Uraba. This is the border ground of the wild "Cunos," or San Blas Indians, whose good will must be propitiated. Hence this river is seldom or ever ascended except by them when they wish to reach their highlands by a short cut. There is hardly any current perceptible, and there is considerable depth of water at the confluence of the Arquia, with the Atrato, even for the largest ships. When I was at San Pablo in July last, Sir J. N. Duraner, Governor of Choco, informed me he purported making an exploration of this river, convinced, as he was, that it was *one* of the best *routes* through which an advantageous *inter-oceanic transit* could be effected. This person has resided more than forty years in the Choco, has explored many of the rivers intersecting the Cordillera, and has influence among the Indians. He has promised to acquaint me with the result of the expedition, though I fear it is too great and arduous an undertaking for a single individual to achieve, unaided and unsupported. This knowledge, experience, and co-operation would prove invaluable in any future survey that may be undertaken in those parts, and would be cheerfully imparted by him.

11th. I will now call your attention to still another point which, I consider, presents even greater facilities than the above, and with which I am better acquainted.

About fifteen miles above the confluence of the *Arquia*, there is another river called *Cano de Caccarica ;* no current being perceptible, the term is applied as being a channel, not a river; for this Cano communicates with three or more large lakes, the most westerly having been described to me as an inland sea. This chain of lakes extends due west, also in the direction of the Gulf of San Miguel, and are seldom visited, from their propinquity to the San Blas Indians.

For the reasons above stated, I could not attempt the exploration, but some years after, my cousin, Col. G. Porras, of the

New Granadian Army, made the attempt. He assured me he had penetrated as far as the second lake, which he found to be much larger than the first. Owing to the illness of his guide and want of provisions, he could not proceed further. The guide stated the third lake was still larger, like a sea, from which he was not far distant, and whither he engaged to conduct Col. Porras, as the intervening country was sufficiently low to drag a canoe across and launch it into the Pacific. Thus unfortunately terminated this bold attempt, the result whereof would have proved so interesting at this particular period. In case either of these two routes, should, after survey, be found eligible for a *ship canal*, the next important point to be considered is the capability of the harbors on either ocean. Should their terminus on the Pacific side result, as is conjectured, to be any where in the Gulf of San Miguel, a better harbor or series of harbors can hardly be found, and no description thereof is requisite here.

The harbor on the Atlantic side is the port of *Turbo*, in the Gulf of Uraba. This is susceptible of much improvement. There are bars at the different mouths of the Atrato, five in number, which vary in depth from four to nine feet, and of inconsiderable width. Immediately on passing these bars you arrive in *deep water*. It is for scientific men to determine how this difficulty may be overcome; but I may be permitted to say that I do not consider it insurmountable, nor even very difficult to overcome. The main mouth, which is also the widest and straightest, Barbacoas, is about 200 yards wide, and the bottom is of hard sand. By closing the two mouths contiguous on either side of "Coquito" and "Matuntervo," a larger body of water would run through Barbacoas, and impede the foundation of a bar at its mouth. A series of piles could also be carried out into the bay to guide the discharge of the river as far as *deep water*. I am also of opinion that there are other means of improving this harbor, that will render it adequate for the purpose, provided always the main point of a *ship* canal or *inland navigation through a chain of lakes*, be accomplished.

Turbo (see map) is a new settlement formed on the main land or eastern side of the Gulf almost opposite to the mouths of the Atrato. It has been declared a free port since 1st January last. A road is being opened thence to the provinces of Antioquia, so rich in auriferous ore, and abounding in mines of silver, copper,

&c., &c. It is contemplated that merchandize can be conveyed across the road in four or five days. The Province of Choco is also exceedingly rich in mines of the purest gold, platina, &c., &c., hitherto imperfectly worked by ignorant natives. Whenever they may be explored by foreigners, I feel assured they will prove to be *richer than those of California.*

When I was last at Turbo, I conversed with Col. Porras about the Carro de Cacarica, and he manifested great readiness to accompany any party that might be sent out to explore that terra incognita. He has resided many years in the Choco, and traversed the country in all directions. He would prove an excellent pioneer, is enured to the climate, and has an iron constitution. He also possesses great influence among the different Indian tribes. In such an event I also tender my services, feeling equally convinced, as well from Col. Porras' statement as from my own observations, and the reports of the Indians, that this point will prove to be the most eligible, through which a proper and efficient ship canal may be cut.

This I consider the grand desideratum now required by the spirit of commercial enterprise of the whole world, and, as I have before said, is more particularly required by that of the United States. To quote the words of a writer in the Encyclopedia Britannica, I also here ask:—

"But by whom is a ship canal to be accomplished? The ques-
"tion is not a British one alone, nor even an *European*; it is more
"particularly an *American* one; though the whole commercial
"world would be more or less remotely affected by it."

When this was written, Oregon and California had not been annexed to this powerful Republic. Hence, I would respectfully add, that at no more opportune period has it become the paramount interest, and even the duty of its government to take the lead in so grand and so important an undertaking, which its citizens are so peculiarly adapted to carry out, from their superior undaunted energy, enterprise, and perseverance; for in these qualities they surpass their ancestors, owing, doubtless, to the amalgamation of the different European races, found to be so happily combined in these their descendants.

It is true that this Government readily co-operated with those of England and France in sending its contingent for the late explora-

tions that have been effected across the Isthmus of *Darien*. The world anxiously awaits to learn the definite results thereof, and it would be premature to form any precise judgment thereon. But should it unfortunately result that the undertaking be deemed impracticable at the points explored, I beg respectfully, through your honorable medium, to call the serious attention of your Government and your enterprising countrymen to the importance and necessity, *now* more than ever, of steadily prosecuting this grand undertaking, so deeply affecting its future welfare and prosperity, the haply accomplishment whereof, at no far distant day, *must* make this favored country the focus or centre of the whole world's commerce, from east to west, and from north to south. Then indeed may this City be most appropriately called the "*Empire City*," as it would then inevitably become.

You have honorable instances before you, and perhaps one is here present, of private individuals, who have, single handed, unsolicited and unaided, grasped at undertakings of immense magnitude, never despairing, never dreaming but of ultimate success; like the great Napoleon, the word "impossible" is not to be found in their vocabulary; whose only reward may prove the pleasant satisfaction of rescuing the lives of a gallant British officer and his brave companions, a feeling all must envy, as honorable to his head as to his heart.

Surely then, there will, there cannot be found wanting, spirited individuals in this very City of New York, who, by association, will prosecute this long-wished for enterprize, whether supported or not by their Government.

In conclusion, I will observe that the expenses of an expedition to explore and survey these two last points would not exceed $10,000. Two experienced Engineers, with the cooperation of Col. Porras and myself, if required, and a dozen of the natives for boatmen and axemen would be sufficient for all purposes. A stock of provisions for four months would be required, as that part of the country is almost uninhabited and without any resources, beyond game in every variety—it being the hunting ground of the Indians. The passage hence to Carthagena by steamer is about $150—by sailing vessels only half; the voyage is performed in about 15 days; thence to the Atrato, it is only 2 or 3 days trip in the boats of the country. A good draftsman might be usefully added. The labor

of the natives costs from six to eight dimes a day. The expedition could return in four months or sooner, and might visit other adjacent points; the Napipi and several other rivers, the Jurado, Cuparado, Pato, &c., &c., of which I have not deemed it necessary to treat in this sketch, not wishing to intrude further on your valuable time and attention. And craving your kind indulgence for this crude and imperfect *brochure*, I tender you my warmest thanks for the honor that has been permitted to me, of addressing so respectable an auditory.

Having deemed the above sufficiently long for one lecture, I have added as notes, a few more particulars about this curious tribe of "Cunos," which may not be deemed irrelevant, as every circumstance regarding this singular race will, I trust, be considered of interest, from the circumstance that they appear destined to play some conspicuous part in the future events that are likely to transpire on the Isthmus of Darien. I leave these notes with your Secretary—Mr. S. DeWitt Bloodgood.

New York, No. 58, 7th Avenue, May 8, 1854.

NOTES.

A. Mr. E. G. Squier, late Charge d'Affaires to Nicaragua, has shown me an ancient Spanish Map of the whole Island of Darien, &c., which corroborates the idea I have suggested, of a gap in the Andes about Cacarica and Arquia.

B. It would be highly important were geographers to decide this point whether there be two Isthmuses or only one.

C. Among these, the *Canna* Mine was so exceedingly rich in gold, that the Governor of Spain ordered the Viceroy to have it closed, to deter the Buccaneers from their marauding expeditions to that point of the Isthmus.

D. It is stated that the late explorers met with no assistance from these Indians, on the contrary, they molested them, killed four of the Virago's party, stole all their provisions, &c., &c.; studiously avoided meeting them, and destroyed their farms, canoes. &c., to throw every obstacle in their way, thereby causing the death of six persons of Lieut. Strain's party.

E. Dr. Cullen pretended he possessed great ascendancy over the Indians. We do not learn that he acted as pioneer or mediator to any of the exploring parties.

F. So jealous are they of any encroachments of the Spaniards, that some 15 years ago they surprised and massacred a party of twenty fishermen, for intruding on their fishing grounds, where large quantities of Turtle (producing the Tortoise Shell) are caught every season.

ARTICLE V.

RAILROAD TO THE PACIFIC.

BY HENRY V. POOR, ESQ., EDITOR OF THE "RAILROAD JOURNAL."

In an age particularly distinguished for its progress in the mechanical sciences, it is natural that an achievement which presents the greatest difficulty, to be followed by the greatest reward that has yet crowned human effort, should possess a paramount interest with a people as utilitarian as our own. It is characteristic of them that they never rest satisfied until they have brought into their service whatever improvements in the economy of life, science has discovered and art wrought out. The pioneer, as he moves forward over the prairies of the West, carries with him the railway,—as necessary in his catalogue of wants as are the axe and the plough. The railway keeps pace with the frontier line of settlement; so that the crop this year, of the frontier farm, in the great march of civilization, has only to be held to the next, to be sent whizzing to the Eastern market in the rail-car, at the speed of thirty miles to the hour!

The progress of railways kept pace with the onward march of our people, till the Mississippi was fairly crossed, when the intermediate territory to the Western ocean, was cleared at a single bound. Upon its shores have been achieved in five years, what have required two hundred to accomplish upon the Atlantic coast. Five years have witnessed the birth and growth, to the features of a mature manhood, of a mighty State upon the Western slope of the continent, which, in addition to more than *fabulous* wealth in its soil,

commands the trade of the Pacific Ocean and the innumerable lands it washes. The focal point of all this commerce is the little island upon which we stand. To reach and enjoy this commerce, we have been unable to bring into use the greatest of all human contrivances—the *railway*. So accustomed have we become to the luxury of its use, that we cannot visit a neighboring village, a few miles distant, without it. It is proof conclusive, that no business nor people worth visiting exist, where no such work is found. If we have, perchance, a country friend, whose *locus* cannot be found in a guide-book, we coolly inform him that when the railroad finds him out, we will try to. What wonder, then, that we are impatient at being cut off from California, from Oregon and Washington Territories, from the Pacific Ocean—its beautiful shores and islands teeming with wealth and busy populations, and ready, if we could reach them, to pour a flood of wealth into the lap of our people. "We must have a railroad to the Pacific," is the demand of a great nation. How shall we get it? is the problem before us for solution.

The American Geographical Society has not shown itself indifferent to a subject which is exciting such general and profound interest. The object of its organization was, to collect and diffuse "*geographical information.*" It was felt that there was no more appropriate or interesting field for their labors, than that portion of the country through which is to be constructed the great commercial avenue to the Pacific. As the most important step toward accurate geographical ideas, is an intelligible and authentic map of the earth's surface, one of the first labors of our infant society was to construct the magnificent one which now hangs upon our walls. This map, though unfinished, is by far the most complete of the kind yet executed of the western portion of the territory of the United States, and presents to the eye an amount of information that can be had from the perusal of no other single work. The construction of such a map was a proper initiative for a society like our own. When completed, so as to embrace the whole of the United States, with the territories contiguous, its value, as a means of diffusing correct information, will repay, not only its cost, but all the efforts that have yet been put forth to found and rear the "Geographical Society."

"A railroad to the Pacific," is a complex proposition, in which are united numerous elements entirely *dissimilar* in themselves. One of these, and a very important one, is the degree of inclination

of the earth's surface upon the whole, or any part of the line. Another are the obstacles in the way of a *direct* line. A third is the ability of the route to supply to the road, wood and water. A fourth are the expedients to be resorted to for the crossing of rivers and mountains. Considerations like these belong to the *scientific* or engineering department of the road. To another department belongs the duty of providing the ways and the means; a third, the general administration of affairs. In a work like the Pacific railroad, it is not easy to say which of the departments involve the greater difficulties. The engineering, probably, presents the fewest, as, at the present day, nothing is difficult or impossible with *money*. The tunneling of the mountain barrier itself is a mere question of dollars and cents. These supplied, and the engineer has nothing before him but *plain sailing*.

It will be seen, from what I have said, that were I competent, I might occupy a month of your time in discussing the subject of a Pacific railroad, without saying all that was interesting or desirable to be known. A single paper, for an hour's entertainment, were it only to touch upon the various heads embraced in the general proposition, would be valueless for its superficiality. Were it to do more, it would be insupportable from its prolixity. I shall not attempt either, but what will be much more interesting and useful, I propose to offer a few remarks in description of some of the leading characteristics of the country upon the several routes proposed, with such observations as these may naturally suggest, bearing upon the general question. In other words, I propose to read a brief paper the principal object of which will be, to illustrate the subject of a railroad by the use of the map and profiles which you have before you.

The United States, in reference to its geography, may be divided into three grand, well-defined divisions, each possessing characteristics peculiar to itself. They may be termed generally the *Eastern*, *Middle* and *Western* divisions. The first lies between the crest of the great Allegheny ridge and the Atlantic; the second extends from the former to the commencement of the great American desert, at the base of the Rocky Mountains; the third, is, the intermediate territory from the last to the Pacific Ocean.

With the *first* and *second* of these divisions most of us are personally familiar. There are some strong points of resemblance be-

tween them. They have a nearly uniform climate upon similar parallels. They are sufficiently watered from rains, and wooded for agricultural purposes. They are both penetrated by navigable rivers. The surface or topographical features of both are favorable to the easy construction of railroads and ordinary highways. In these particulars, these divisions are in fact so homogenous in their leading aspects, that, contrasted with the third, they may be regarded as one.

The *third* grand division presents a most striking contrast to the two already described. Perhaps its most remarkable characteristic is its great general elevation above the level of the sea, as it is to this elevation that many of its other peculiarities are due. This feature must be thoroughly studied and understood, in order to form a correct idea of the character of the country on the several routes, and the difficulties in the way of the construction of a railroad.

The Mississippi river, in connection with its main affluent, the Missouri, is the dividing line between two great *planes*, one descending to its *left* bank from the summit of the Alleghenies, the other to its right, from the summit of the Rocky Mountains. The uniform and gradual descent of different portions of this great river is very remarkable. From the Gulf of Mexico to the Grand Falls of the Missouri, a distance of 4,000 miles, there is no obstacle to the running of light-draught steamboats at all seasons of the year, when the river is unobstructed by ice. From the mouth of the Ohio to the Gulf, a distance of about 1200 miles, the fall is 275 feet, or nearly $2\frac{3}{10}$ inches to the mile. From the mouth of the Ohio to the Grand Falls of the Missouri, and to the Falls of St. Anthony on the Mississippi, the descent of the two rivers is nearly uniform; that of the Missouri being the greatest by about one inch in the mile. From the Falls of St. Anthony to the junction with the Missouri, the descent is about 495 feet in a distance of 760 miles, or at the rate of $6\frac{1}{2}$ inches to the mile. From the Grand Falls to its mouth, the descent of the Missouri is about 1900 feet in 2600 miles, or at the rate of 7 3-10 inches to the mile. Gov. Stevens estimates the elevation of the river, at the mouth of the Yellow Stone, at 2000 feet above the sea, and at the Grand Fall 2300 feet. As the distance between these points is about 700 miles, the descent of this portion of the river is only about one-half as great as it is near its mouth. We

presume that the first few hundred miles of the Mississippi, immediately below the Falls of St. Anthony, exhibits a similar peculiarity. If so, the upper portions of both rivers show a remarkable fact in the topographical features of this country, and present a striking exception to a general law which seems to be observed in the fall of rivers.

At the Grand Falls of the Missouri, the river descends over a series of cascades 368 feet, in the course of 18 miles. Above the Falls, the inclination of the river does not appear to increase very rapidly, as it is navigable for canoes for five hundred miles, and to a point within 38 miles of the waters of *Clarke's* Fork of the Columbia. This was the route pursued by Lewis and Clark, on their way to the Pacific. At this point their expedition left the river; the elevation does not probably exceed 3,168 feet. From thence to the source, in a distance of about 25 miles, the rise is probably not less than 3000 feet. The uniform inclination of this great river, throughout its whole course, constitutes one of the most remarkable facts in the topographical features of the North American continent.

As before stated, the Mississippi and Missouri rivers mark the boundary of two great *planes*, reaching to them from the summits of the mountain ranges on either side. A striking contrast presented by these planes, is in their *dip* or inclination to the point of their intersection, and their geological structure. While there is a great difference in the elevation of their upper angles, there is still greater difference in the inclination of the rivers which traverse them. The rock forming the Allegheny ranges being chiefly limestone, the rivers that fall from them have cut for themselves deep channels, far below the general surface of the country. They consequently have a gentle flow, with sufficient water to render them navigable for a great portion of the year. The main tributary entering the Mississippi from the East is the Ohio. The descent of this river from Pittsburgh to its mouth, a distance of 975 miles, is 424 feet, or at the rate of 4 32-100 inches to the mile. Following up the Allegheny to *Olean*, in the State of New York, the head of steam navigation, a distance of 250 miles, we find the descent rapidly increasing. The elevation of this point is 1,403 feet above the sea, or 704 feet above Pittsburgh, showing a fall of two feet eight inches to the mile. In fifty miles more we reach the sources

of the river, in the town of Friendship, in this Sate, 1,678 feet above the sea, and 2,456 miles from the Gulf.

If we examine the Tennessee and Cumberland rivers, which, with the Ohio, drain the greater part of the western slope of the Allegheny range, we find them possessing the same general characteristics as the Ohio. The Tennessee river at Chattanooga, 600 miles from its mouth, is 351 feet above the Ohio, showing a fall of about 7 inches to the mile. Above Chattanooga, the ascent increases rapidly; and upon entering the State of Virginia, about 300 miles from Chattanooga, an elevation of about 1,000 feet is obtained. From the State line to its source, the ascent is about 1,550 feet, in about 125 miles.

The Cumberland, lying within the circle described by the Tennessee, has less descent; the fall from Nashville to its mouth being only 104 feet, in a distance of 240 miles, or at a rate of 5⅕ inches per mile. The inclination of the head waters of the Cumberland river, does not differ much from those of the Tennessee.

I have been particular to give you the inclination of the rivers draining the western slope of the Alleghenies, or the great *eastern* plane of the Mississippi, that you may better appreciate the consequences that result from the greater slope of the corresponding plane upon its western side. The slight descent of the Ohio, Tennessee, and Cumberland rivers, give them gentle currents and deep channels, peculiarly adapting them as avenues of commerce. On the other hand, in ascending the table-lands which fall towards the *right* bank of the Mississippi and Missouri, we find that the rivers which traverse them have an inclination nearly *ten* times greater than those which enter the former upon the left. For the purposes of this paper, the comparison will be confined to the Arkansas and Platte, as these define *two* routes for the proposed road, and constitute, from their positions, and general directions, appropriate contrasts to the Ohio, Cumberland and Tennessee, and also afford the best illustration of some of the peculiarities of the great western plane they water.

The Arkansas river, entering the Mississippi only about seven hundred miles above its mouth, within what may be termed the great *delta* of the Mississippi, and at an elevation of about 150 feet above the sea, the lower portion of it presents some of the characteristics of its recipient. It has a steamboat navigation to *Fort Smith*, about 500 miles, by the course of the river.

In this distance the descent is probably 250 feet. In longitude 97° west from Greenwich it probably reaches about the same altitude as the *Platte* river at its mouth in longitude 96°. At these respective points the two rivers present similar characteristics, having rapid currents over wide sandy bottoms with low banks, and are entirely unfitted for any commercial purposes. Their respective elevations above the sea are about 1,000 feet. As we ascend the great *plane*, the two rivers maintain nearly the same altitude, showing a remarkable uniformity in the general surface of the country. From the mouth of the Platte to Fort Laramie the distance is about 575 miles, and the descent of the river 3,550 feet, showing a rate of fall of about six feet to the mile, or *sixteen* times greater than the Ohio. From Fort Laramie, to the South Pass, the descent is at the rate of 10½ feet to the mile, in 185 miles; the crest of the Rocky Mountains at this point being 7,490 feet above the sea. The descent of the *head* waters of the Platte are nearly five times greater than that of the head waters of the Ohio. The rate of the fall of the *Arkansas* very nearly corresponds to that of the Platte. From the great Bend of this, in longitude 98 west from Greenwich, to Bent's Fort, which like Fort Laramie, lies at the base of the mountains, the descent of the river is 2,300 feet, in 311 miles, or, at a rate of 7½ feet to the mile. From Bent's Fort to the summit of the *Sangre Dez Christo* Pass, the descent is 4,942 feet in 121 miles, which is at the rate of 40 feet to the mile. Bent's Fort is 3,858 feet above the sea, and the summit of the Sangre De Christo Pass, is 8,800 feet according to Capt. Gunnison. The fall of the upper portion of the Arkansas is more than twenty times greater than that of the Allegheny.

Another great river possessing characteristics very similar to the above, though having a different direction and outlet, is the Rio del Norte. All three take their rise in the same great elevated *Plateau*, the Platte and Arkansas draining its Northern and Eastern, and the Del Norte its Southern and South Western slopes. The descent of the upper part of this river is much greater, probably, than either of the former. From San Felipe, in lat. 35° 30′ to a point near the Mexican boundary, the river falls at the rate of four feet per mile, San Felipe is 5,158 feet above the sea, Santa Fe, 6,846. San Felipe is more than 300 miles south from the source of the river in the famous *Coochatoopee* Pass, the water from the southern

slope of which falls into the Del Norte, at the rate of twenty feet to the mile, which is only one-half of the descent of the Huerfano from Bent's Fort to the Sangre De Christo Pass, and which Fremont and Heap describe as a very level route, we have 11,158 feet as the elevation of the Coochatoopee Pass, which is only 76 feet higher than the measurement of Gunnison makes it; viz. 11,082 feet.

It must be borne in mind that the elevations I have given are not those of mountain *summits*, but of the lowest depression between them, such as are followed by the water courses and have been selected on account of their great depression and favorable features as the great routes of travel to the Pacific. The general elevation of the neighboring planes is much greater, while upon all sides of these *passes* tower mountains covered with perpetual snow.

It is easy to see that the inclination of the above rivers entirely unfits them for navigable purposes. They have wide shallow channels with beds but slightly depressed below the general elevation of the country contiguous. In some parts of their course they nearly lose themselves in the sands over which they run. In many places the Del Norte disappears for miles, presenting when it re-appears its full volume of water.

These facts render the country traversed by these rivers inaccessible by the *steamboat*, which has thus far been the pioneer in the westward movement of our people, and constitutes one of the great obstacles to the construction of a Railroad to the Pacific.

The foregoing remarks have been descriptive of the *Eastern* and *Southern* slopes of the great Rocky Mountain Range. Upon reaching the summit of the plane or plateau, from which these mountains rise, we find it extends with very little depression, except where it is intersected by the waters of the Colorado and Columbia, to the Sierra Nevada on the Pacific. The great uniform elevation of the territory embraced within these mountain ranges, is one of the most distinguishing features in the topography of this Continent, and one of the most remarkable of the globe. Nearly every portion of it is thickly studded by ranges of mountains some of which vie in elevation with those that enclose them. If possible, the country is still more barren than that already described. Throughout is the same absence of water and wood. The sands drink up the feeble streams as they descend from the snowy hills. Nothing can be cultivated except by irrigation, which is confined to the narrow bottoms of the

water courses. All else presents the desolation of the desert in all its hideousness. From North to South, this desert extends from an unknown distance below the Mexican boundary nearly to the British Possessions, and probably covers the larger portions of Oregon and Washington territories. Its breadth embraces about 22 degrees of longitude and measures from 900 to 1100 miles. Its general elevation is about 4,500 feet, while throughout its whole extent rise mountains from 10,000 to 15,000 feet high. Within it is the desert of the Great Salt Lake which is elevated 4,200 feet above the sea, and which has a system of mountains and rivers peculiar to itself.

The first grand consequence that results from the great elevation of so large a portion of our continent, is the absence of *rain*. Its height above the sea would largely reduce the quantity, were there no other causes which influence the same result. Either side of the great plateau is flanked by the ranges of the Rocky and Sierra Nevada Mountains, which, intercepting the moisture borne into the interior from the sea, precipitate it upon their lofty summits. This fact explains the cause of the immense masses of snow which collect in the mountain gorges, particularly of the Sierra Nevada. Upon crossing these mountains into the great desert, the snow which accumulates in such immense bodies upon the western slopes, disappears. The same fact is noticed upon the Rocky Mountains, although their influence is not so striking as that of the Sierra Nevada, from the greater elevation of their base, distance from the sea and the drier atmosphere by which they are surrounded. Upon their eastern slopes only a small amount of moisture falls. This is collected upon the lofty mountains, whose heights are sufficient, by the changes of temperature which they cause, to disturb the ordinary equilibrium of the atmosphere, and condense upon their summits the moisture held by it.

This great elevated plateau which embraces the Eastern and Southern slopes of the Rocky Mountains, extending from 250 to 300 miles from their base, presents all the characteristics of a true desert. On the East, the boundary of this desert may be described by a line drawn from the mouth of the Yellow Stone to the great bend of the Arkansas near the point of intersection of the parallel of latitade 38, with longitude 99. The line thence extends very nearly South, inclining a little to the west after entering Texas, and

inclining to the east again on approaching the Rio Grande, and leaving a wide belt of desert country east of the river, to its mouth. Within the limits of this desert is the great Llano Estacado of Texas, an elevated and treeless plain. In latitude 31, 30, Bartlett's Expedition crossed it, and for seventy miles from the Choncho to the Pecos, found no water. In latitude 32, 30, its width is more than double the above. Between the Pecos and the Rio Grande, a distance of about 200 miles, is a high barren plain, portions of it being 5000 feet above the sea.

One of the most remarkable features of portions of this great desert, particularly that of the Great Salt Lake Basin, is the aspect of *newness* which it presents. Rain is the grand disintegrator of the earth's surface. Where it does not fall, the lapse of ages produces no perceptible change in the aspect of nature; consequently portions of the great American Desert present the same appearance they did ten thousand years ago. It seems not to have been disturbed since the warring forces of nature laid down their arms. This warfare would appear to have ended but yesterday. The yawning chasms, the blackened hills, the angular and jagged masses of rock piled up in endless confusion, the heaps of scoria glistening as if it ran from the furnace of yesterday, the vast plains unenlivened by a single specimen of organic or animal life, all bear witness of the external action of those terrific agencies, which now quietly repose in the bowels of the earth. Over the scene of their warfare, through the agency of milder forces, no veil has been thrown. It remains, and always will remain, intelligible alike to the lettered and unlearned, a record of a great crisis in the earth's history.

Throughout this desert wherever running water is found, its sources are always in lofty mountains. These streams constitute the oases of the desert, and are oftentimes separated by *jornadas* or sandy plains without water, all the way from 10 to 100 miles in extent. In the winter, which is the rainy season, these are crossed by mule trains with comparative safety, as portions of them abound in grass. In the summer or dry season they are nearly impassable both for man or beast.

Such is not an overdrawn picture of the physical characteristics of a territory embracing nearly one-half of the breadth of the North American Continent, and over which must be the route of most, if not all, the proposed Railways to the Pacific. I have been particu-

lar nót only to describe it with sufficient distinctness for the object I have in view; but, to contrast its peculiarities with those portions of the country with which we are all familiar. In this manner only, can a correct idea be formed of the magnitude and difficulties in the way of construction of a Pacific Railroad. We are apt to regard the obstacles to such an undertaking the same in *kind*, as those encountered in the construction of a railway east of the Mississippi River. If the Erie Railroad with a line of 500 miles, has cost $35,-000,000, we take it for granted that a Railroad to the Pacific of 2000 miles of line would cost $140,000,000. Nearly every person in the United States takes the road with which he is the most familiar, as a proper illustration of what the Pacific Railroad is to cost, and solves the problem by multiplying the length and cost of his own into the one proposed to be built.

To this fact, we may ascribe the ready garrulity of all of us upon a subject, of which those who really appreciate its magnitude, approach to say the least, with awe.

The proposition before us involves the construction of a railroad for a distance of nearly 2,000 miles through an uninhabited, and for the greater part, we may say an uninhabitable country, nearly destitute of wood, extensive districts of it destitute of water; over mountain ranges whose summits are white with eternal snows; over deserts parched beneath an unclouded sky, and over yawning chasms which the process of disintegration since the volcanic fires were put out, has not yet filled up. How is a sufficient force to be maintained upon such a work for its construction? And how is the road to be kept in repair and operated after it is built? How is the locomotive to be supplied with its food, wood and water? These are some of the questions that are to be discussed and solved; not the necessity that exists for the work. This requires no demonstration.

For the Pacific Railroad *five* routes are proposed, which may be designated as the Northern or Missouri, the South Pass, the Central or Benton's, the Albuquerque and the Southern. I propose to notice, briefly, the features peculiar to each.

1st.—THE NORTHERN ROUTE.

The proper base of this route, is the western extremity of Lake Superior. From thence it is prolonged in a generally westerly

direction toward the great bend of the Missouri, the valley of which it follows to the summit of the Rocky Mountains. Crossing these, it falls into the valley of *Clark's* Fork of the *Columbia,* which it follows to its juction with the Columbia, and thence along that river to its mouth. This is a route, the entire practicability of which, Gov. Stevens, as we understand, claims to have demonstrated. He entertains a belief that a practicable route may be found from the Columbia to Puget Sound by following up the *Yukima* and crossing the Cascade range in the Sno-qual-me Pass, which is about 3,500 feet above the sea.

A superiority claimed for the *Northern* route is the fact that it coincides with a great depression in the surface of the country extending entirely across the continent, as indicated by the course of its three great rivers, the St. Lawrence, the Missouri and the Columbia. The St. Lawrence entering the Atlantic Ocean in longitude 56, takes its rise in Lake Superior, in longitude 92, spanning in its course 36 degrees of latitude, or more than one-half of this Continent. The distance from Lake Superior to the Pacific is a few degrees less, or thirty-two degrees. Lake Superior is 690 feet only above the sea, from which it will soon be accessible to large vessels. Here then is a highway, already provided, extending one half the way across the continent and the best possible one for commercial purposes.

From the head of Lake Superior in latitude 47, the line has a generally westerly direction, crossing the head waters of the Missisippi at an elevation of about 1,200 feet above the sea, and those of the Red River of the North, a short distance below Lake Traverse, at an elevation of about 1,000 feet. From thence it gradually ascends the *coteau* of the prairies of the Missouri which are crossed at an elevation, propably, of 2,300 feet. On entering the valley of the Missouri, the route adopted by Gov. Stevens avoids the immediate vicinity of the river, keeping upon the elevated prairies for the purpose of obtaining a more direct and better line. In the latitude of the Grand Falls its line is seventy miles north of that point, and 1,300 feet above, or 3,600 feet higher than the ocean. This elevation is gradually increased till the summit of the mountain is reached, some 6,000 feet above the sea. The formation of the mountain ridge is such as to allow of a tunnel of about two miles in length by which the elevation of the road bed

will be reduced to 5,000 feet. From the summit, the descent to the waters of the Columbia is very gentle. At about 100 miles from the summit, the elevation of the waters of the river are about 1,000 feet higher than those of the Missouri, at a corresponding distance; showing the same general fact with regard to the elevation of the country *west* of the Rocky Mountains, already noticed. By taking the Columbia River to its mouth, a favorable route, according to Gov. Stevens, may be had, involving easy grades and no insurmountable obstacle.

The advantages of this route, and in which it is probably superior to all others, are easier grades, a better supply of wood and water, a country upon its line, the agricultural capacities of which are equal to the sustenance of a population sufficient for the maintenance of the road, and the ease with which large bodies of men and material can be thrown upon the work.

The route involves much less rise and fall than any other. Water can probably be found in sufficient abundance upon all parts of its line. Upon the eastern division, abundant supplies of good timber are found on Lake Superior, the Mississippi, and the Red River of the North. From the last named river to the mouth of the Yellow Stone, timber is scantly supplied, and will have to be sought for *off* the main line. One source of supply will be Devils Lake, in latitude 49, longitude 99. The James and Mouse rivers furnish cotton *wood*; a wood, however, poorly adapted for mechanical purposes. On reaching the mouth of the Yellow Stone, pine and red cedar can be obtained from that river. An abundance of good timber is found in the valley of Milk river. On crossing the mountains, the line at once enters a wooded country, which continues on all the water courses to the Pacific. Throughout the whole of this portion of the route, the forests are composed entirely of evergreens.

Another striking advantage which this route possesses over all others, are the greater facilities it presents for cheap and rapid construction. *East* of the Rocky Mountains, the western shore of Lake Superior, the Great Bend, and the Falls of the Missouri, can each be made the base of independent systems of operations. From the two latter, the work of construction can be pushed in either direction. The great advantage resulting from the accessibility of its line, will be better appreciated when we remember

that any required force of men and provisions can be thrown upon it by means of steamboat navigation, which reaches within about seventy miles from the summit of the mountains, upon the meridian of 110°. To reach a corresponding point on any other route, 600 miles at least of desert must first be crossed, over which the only mode of transportation is by the ordinary wagon trains. It is this fact which constitutes the great obstacle to the construction of all but the northern route. The operations of a railroad company are like those of an army, the cost and difficulty of the maintenance of which increase in *inverse* ratio as the scene of its action is removed from its *base*. Upon all other routes the railroad, as it progresses, must constitute the only means of keeping up communication with advanced portions of its line, and of supplying to it all the materials and force employed in construction. To a person familiar with the construction of roads of inconsiderable length, the increased delay and cost arising from the causes named will be readily understood. It is not too much to say, probably, that a given amount of work upon any route proposed, except the Northern, will cost thrice as much, and occupy thrice the time that would be required for an equal amount upon any road east of the Mississippi.

Upon crossing the mountains, the Columbia will also contribute an important service toward the construction of the road, as the river can be used as a means of supplying material and labor.— Governor Stevens estimates that there are only 500 miles upon the whole of this route which cannot be made accessible by navigable water courses.

The objections to this route are, its extreme northern latitude, the great degree of cold which is known to prevail during the winter months, and the fact that it does not look to San Francisco as its Pacific terminus. These are serious objections. There appears, however, to be no sufficient cause for the apprehension which exists, that the snows will constitute any serious obstacle to the running of the trains. It seems to be well settled that only a small depth of snow falls upon the plains of the Upper Missouri. Horses find no difficulty in picking up a comfortable living upon them throughout the winter. They are the winter and summer range of countless herds of Buffalo. Parties left behind by Governor Stevens found no difficulty in crossing the mountains several times during

the winter with horses. As soon as the mountains are crossed, and the waters of the Columbia are reached, the influence of the genial climate of the Pacific begins to be felt.

At the present time, San Francisco is the appropriate terminus of a railroad to the Pacific; but the best route by which it is to be reached, remains to be shown. There is no evidence that the *Northern* is not the best route, even for San Francisco. This important city is, unfortunately, the most difficult of access by railroad, of any point on the Pacific within our possessions. There is no sufficient evidence to show that it can be reached at all with any amount of money that can reasonably be expected to be obtained for such a work.

2D—THE SOUTH PASS ROUTE.

The next route in order is the "*South Pass.*" This route is now not generally insisted upon. The leading objections to it are the exceeding sterility of the country traversed by it, the almost entire absence of wood, and the immense elevation of a very extensive portion of it, as will be seen by the profile before us. More than 1,000 continuous miles of it are elevated 4,000 feet and upward above the sea. The South Pass summit is 7,490. The Bear Mountain summit 1,000 feet higher. These elevations, in the latitude in which they occur, render this a much colder route, and one more liable to snows, than the Missouri. It would probably be impossible to keep up a communication on this route in the winter season, a fact that must prove fatal to its claims, which, I believe, have ceased to be pressed. It may be proper to state, that this is the route so long and pertinaciously urged by Mr Whitney.

3D.—CENTRAL ROUTE.

The next route is the "*Central,*" or what is more commonly termed *Benton's* route. If the measurements of the height of the different passes upon it are correct, their great elevation must constitute a fatal objection to its adoption. The course of the rivers indicate that this route crosses the highest *table* of the *plateau* already described, it being the source of the Platte, Arkansas, Del Norte, and Colorado rivers, all running in different directions. The indications furnished by the course of the streams are against

the practicability of this route; and I expect to see them confirmed by the results of examinations and surveys. It cannot be that the *lowest* summits are to be found, where rivers running in opposite directions take their rise. The *Coochatopee* Pass cannot be far from the snow line at any portion of the year, and the glowing accounts which describe this valley as the favorite resort of summer, in mid-winter, must have been the creation of a poetic fancy. At 11,000 feet above the sea, in latitude 38°, winter holds almost undisputed sway. Heap tells us in his Journal, that the mountains near the head of the Del Norte are called the *Wet Mountains.* He says that rain fell every day in the valleys, which was snow on the mountains, while he was in this vicinity about the middle of June. These facts attest their extreme elevation, and show that immense masses of snow must accumulate in their gorges in the winter season, without a doubt rendering them impassible. It should be borne in mind, also, that Capt. Gunnison makes the *Sangre De Christo* Pass 8,800 feet high, a fact which destroys all probability of its practicability in the winter.

On entering the great desert west of the Rocky Mountains, the indications furnished by the course of the rivers are not favorable to the Central route. As yet, however, this portion of it is a *terra incognita*, about which it is useless to speculate, until more is known. It is proper to state, however, that the claims of this route are strongly supported by Mr. Benton and Col. Fremont—than whom none should be better informed in reference to the country between the Mississippi and the Pacific.

4TH.—ALBUQUERQUE ROUTE.

The next route in order is the Albuquerque route. East of the Del Norte, the line of this route will probably follow the valley of the Canadian, which pursues a favorable direction, with easy grades. After crossing the Del Norte, the route will take the Valley of the Zuni to the Colorado, which it will probably cross near latitude 35°. From thence it can be carried either to San Francisco or San Diego, as the facts shall justify. The merits of this route are, the central position it occupies, its directness, and favorable alignment of its eastern portion. An examination of a map would, we think, indicate this to be the most favorable of all the southern routes, as

far at least as the Del Norte. Beyond that point we do not yet possess sufficient information to speak with confidence. The great obstacles in the way of the construction of it are the lack of timber and water. It would probably suffer no obstruction on account of snows.

5TH.—THE SOUTHERN ROUTE.

The last to be described is the *Southern* route. This may be made a convenient one for all of the lower Mississippi Country, south of and including Memphis. Assuming Shreveport, in latitude 32° 20′, as a point, the line to be pursued will be a very direct one to El Passo upon the parallel of 32°. From thence it will be continued over nearly the same parallel to the Colorado, near the mouth of the Gila, and thence by some route, not yet defined, to San Diego or San Francisco.

The characteristics of this route, do not differ materially from the one last described. East of the Rio Grande its construction will probably be more difficult. About 150 miles of it will be over the *Llano Estacado*, or *Staked Plain*, a high, barren and treeless table, lying between the head waters of the Colorado, Brazos and Trinity rivers of Texas, and the Pecos. The elevation of the line upon this table will be about 3,200 feet. From the Pecos to the Rio Grande, a distance of 200 miles, an equally barren and more elevated region is crossed. The summit between these rivers is 5,000 feet high, which is the same as the proposed tunnel in the *Northern* route.

After leaving the Rio Grande, a still higher summit is probably attained. The general surface of the country, however, is favorable to the San Pedro, and probably to the Gila. At about the parallel of 32° 30′ according to Bartlett, "the Rocky Mountains suddenly drop off about eight miles south of the Copper Mines of New Mexico, (now Fort Webster,) and, with the exception of a few spurs, seem to disappear entirely. Here we emerge into the great plateau or table land, which, with scarcely an interruption, extends more than a thousand miles to the south. The elevation of this plateau varies from 4,000 to 5,000 feet above the level of the sea, and is crossed by no continuous range of mountains for the distance stated. Short, isolated mountains and hills, alone, appear at inter-

vals, and these are sometimes separated by fifty or a hundred miles of plain.

The great mountain chain which so abruptly terminates near the Copper Mines as stated, again begins to appear in about the parallel of 31° 20′, a few miles north of the Gaudalupe Pass, through which runs Col. Cook's road. The range is here called the Sierra Madre, and forms an almost unbroken chain through the entire length of Mexico. Within fifty miles to the south there is another pass for mules, but beyond this, none for more than 500 miles.

The Gila is closely hemmed in by elevated mountains for about one-half its length; or to a point about fifty miles below the mouth of the San Pedro river. Some of these mountains extend ten or more miles into the plain, so that it is an absolute impossibility to construct a highway near that river.

The district, or belts of country, which lies between the northern spur of the Sierra Madre, and the southern spurs of the Rocky Mountains, may be safely set down at from 80 to 100 miles in width, and extend entirely across the continent from the Rio Grande to the coast range of mountains on the Pacific. In it are no continuous chains of mountains, such as will present an impassable or even a serious barrier to the construction of a railway. This plain is crossed at intervals of from 15 to 30 miles, with short and isolated ridges of mountains, having an elevation of from 1,000 to 2,000 feet above the plain, and running from north-west to south-east."

The absence of mountains on this route implies a corresponding absence of wood and water. It is probably more deficient in these than any of the routes before described.

The territory upon its line is the most barren of all. Of the desert portion, Mr. Bartlett states that not one-half per cent. is arable land.

Mr. Albert Pike, of Little Rock, Arkansas, in an address before the Southern Convention, recently held at Charleston, speaking from his personal observations stated that the desert portion of this route is not worth a *farthing* an acre. For long distances neither stagnant nor running water is found, and trains cannot cross that portion of it between the Rio Grande and the Colorado without suffering severe privations.

On passing the Colorado we encounter the great California desert

which is about 100 miles in breadth, opposite to Fort *Yuma*, and increases in width to the North. This desert is destitute of wood, grass and water. Between it and the Colorado is a belt of moving sand, which will probably oppose a serious obstacle to the construction and maintenance of a railway. The great California desert will have to be crossed by the three lower routes, unless a pass can be found to the North of Walker's Pass, which does not seem probable. It is this desert which is one of the most serious obstacles which all the Southern routes will have to encounter.

After the desert is crossed we come to the Southern prolongation of the Sierra Nevada Range, which constitutes another great obstacle to the Southern routes.

No practicable pass through them into the San Joaquin Valley has yet been found. They rise abruptly from the plains on either side not much elevated above the sea, to the height of over 3,500 to 5,000 feet, and involve grades altogether too steep for the operation of a railroad. Examinations still in progress, may discover more favorable passes, or show that the mountains can be tunnelled at a reasonable expense. By crossing directly to San Diego the summit would not be over 3,000 feet. It is problematical whether the proposed road can be carried to San Francisco at reasonable expense *west* of the Coast range.

I have thus given a few of the leading features of the country to be traversed by the routes of the proposed road. I have also, for a better understanding of the subject, contrasted some of the peculiarities of the Western portion of our Continent with the Eastern. I am aware that this paper is a most meagre and unsatisfactory statement of its subject, partly because we have so little accurate information, and from the fact that a work treating in a proper manner all the problems involved in the construction of a railroad, and in elucidating the peculiarities of the country upon its route, would be the labor of a life, and constitute of itself a good sized library. My object has been to indicate some of the leading conditions under which a road upon *any* route will have to be built. When these are thoroughly appreciated, we shall then go the right way to work. Having taken the right direction, every step will carry us forward. Thus far we have been moving without compass or chart, a sport of every wind that blows.

I see no way in which either of the proposed roads can be built,

without the efficient support of Government. Previous to a careful examination of the subject, I had supposed that the construction of *one* route, at least, could be secured by liberal grants of lands, and by contracts for mail service. I am now satisfied that, unless the general government will furnish a considerable portion of the cost, say $50,000 per mile, and upon favorable terms, the construction of a road upon any of the routes is out of the question. The value of all the lands to be given by Mr. Gwinn's Bill would hardly equal the expenses of a preliminary survey. By Mr. McDougal's House Bill, the Northern route would secure a valuable grant, by means of which 500 miles of railroad probably could be built. Upon none of the other routes would a grant of lands be of any considerable value. I should be very sorry to have Government undertake its construction or management. Perhaps our people would be better off without the road. I believe there is no necessity for this. Let Government advance an amount equal to $50,000 per mile, at an interest of 4½ per cent., and I believe private enterprise would advance the balance required, and guarantee the former from loss, and from the necessity of exercising any interference in the matter. I believe the government should not assume to designate the route to be adopted; but should leave this, and all other questions involved in the construction, entirely to private sagacity and private enterprise. If, with the proposed amount of government aid, *two* roads can be built, let us have *two* routes, a *Northern* and *Southern* one.

If private enterprise will take up only one route, this fact should be viewed as conclusive evidence against the claims of all others. In this way can government shield itself from the charge of partiality, and avoid all entanglement with a work which it is neither competent to construct or manage.

A road upon some of the routes must be built. The wants of commerce, the genius of the age and of our own people demand such a work. *One* road would doubtless prove a fair investment. *One* commercial avenue between two great oceans and between the lands which these oceans surround, *must* pay. As members of the American Geographical Society, or of a still broader community, let us do what lies in our power to aid a work which shall constitute a prouder monument of the progress of our people in the arts of Peace, than nations of the Old World have erected in commemoration of some great achievement in the Arts of Destruction.

AMERICAN GEOGRAPHICAL AND STATISTICAL SOCIETY.

The American Geographical and Statistical Society was incorporated and organized, under the General Law of the State, on the 22nd day of May, 1852. It acted under this charter till the 11th day of May, 1854, at which time it was reorganized under a *special* charter, of which the following is a copy:

AN ACT

TO INCORPORATE THE AMERICAN GEOGRAPHICAL AND STATISTICAL SOCIETY,

PASSED APRIL 13, 1854.

The People of the State of New York, Represented in Senate and Assembly do enact as follows:

§ 1. George Bancroft, Henry Grinnell, Francis L. Hawks, John C. Zimmermann, Archibald Russell, Joshua Leavitt, William C. H. Waddell, Ridley Watts, S. DeWitt Bloodgood, M. Dudley Bean, Hiram Barney, Alexander J. Cotheal, Luther B. Wyman, John Jay, J. Calvin Smith, Henry V. Poor, Cambridge Livingston, Edmund Blunt, Alexander W. Bradford and their associates, who are now or may become hereafter associated for the purposes of this act, are hereby constituted a body corporate by the name of the American Geographical and Statistical Society, for the purpose of collecting and diffusing geographical and statistical information.

§ 2. For the purposes aforesaid the said society shall possess the general powers and privileges, and be subject to the general liabilities contained in the third title of the eighteenth chapter of the first part of the revised statutes, so far as the same may be applicable and may not have been modified or repealed; but the real and personal estate which the said society shall be authorized to take, hold and convey, over and above its library, maps, charts,

instruments and collections, shall not at any time exceed an amount, the clear yearly income of which shall be ten thousand dollars.

§ 3. The officers of the said society shall be a president, three vice Presidents, a corresponding secretary, a recording secretary, a librarian and treasurer, and such other officers as may from time to time be provided for by the by-laws of said society.

§ 4. The said society, for fixing the terms of admission of its members, for the government of the same, for changing and altering the officers above named, and for the general regulation and management of its transactions and affairs, shall have power to form a code of by-laws not inconsistent with the laws of this State or of the United States, which code, when formed and adopted at a regular meeting shall, until modified or recinded, be equally binding as this act upon the said society, its officers and its members.

§ 5. The legislature may at any time alter or repeal this act.

§ 6. This act shall take effect immediately.

STATE OF NEW YORK,
Secretary's Office.

I have compared the preceding with the original law on file in this office, and hereby certify the same to be a correct transcript therefrom and of the whole of said original law.

L.S.

Given under my hand and seal of office at the city of Albany this thirteenth day of April, One Thousand Eight Hundred and Fifty-four.

A. G. JOHNSON,
Dep. Sec.'y of State.

OFFICERS AND TRUSTEES OF THE SOCIETY,

ELECTED MAY 11, 1854.

THE ROOMS OF THE SOCIETY ARE IN THE NEW YORK UNIVERSITY BUILDING.

End of Vol. 1.